PB-216 200

GREAT BASIN DRAINAGE BASIN

Public Health Service
San Francisco, California

1951

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Water Pollution Series, No. 4

PB 216 200

For Clean Water—"One River, One Plan"

Great Basin
DRAINAGE BASIN

A COOPERATIVE STATE-FEDERAL REPORT ON WATER POLLUTION

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FEDERAL SECURITY AGENCY

Public Health Service

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SUMMARY REPORT ON WATER POLLUTION

Great Basin Drainage Basin

Prepared by

FEDERAL SECURITY AGENCY
Public Health Service
Division of Water Pollution Control
California and Great Basin Drainage Basins Office

1951

Details of illustrations in
this document may be better
studied on microfiche.

In cooperation with:

California State Department of Public Health
Idaho Department of Public Health
Nevada State Department of Health
Utah State Department of Health
Wyoming State Department of Health

Public Health Service Publication No. 82

WASHINGTON: 1951

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INTRODUCTION

The Federal Water Pollution Control Act, Public Law 845, passed by the 80th Congress in June of 1948, requires the Surgeon General of the Public Health Service to cooperate with other Federal agencies, with State and interstate water pollution control agencies, and with municipalities and industries in the preparation or adoption of comprehensive programs for eliminating or reducing the pollution of interstate waters and tributaries thereof, and improving the sanitary condition of surface and underground waters.

In developing these programs, due regard must be given to improvements necessary to conserve the Nation's waters for public water supplies, propagation of fish and aquatic life, recreational purposes, agricultural, industrial, and other legitimate uses.

Recognizing the fact that full technical information was not available to permit the development of such comprehensive programs immediately for most of the Nation's waters, the Public Health Service envisioned the development of these programs in two general phases. The first phase contemplated the development of a series of reports, consistent with presently available data, which would: provide a reference point for measuring progress; provide a guide to needed additional data; provide a basis for the logical development of comprehensive programs; provide a basis for approval of loans to States, interstate agencies and municipalities at such time as the Congress made available funds for this purpose; and serve to inform the public on the problem of water pollution and set forth suggestions for pollution control.

The collection of available data as of July 1, 1950, has been completed under the first phase of the program. Such data have been assembled with the cooperation of State and interstate water pollution control agencies. Through these agencies additional data have been obtained from other State officials, county and city officials and representatives of industry. Federal agencies also have been of great assistance. In order to make this information available at the earliest possible moment, these data are being presented in 15 summary-type reports covering the United States by major drainage basins. This report on the Great Basin is one of that series.

These summary reports present information about the ways our water resources are used, the pollution going into our water resources and the resulting damages, the benefits which may result from pollution prevention and abatement, the pollution prevention measures now in effect, and those required.

They are prepared in two parts. Part one considers the water pollution problems of the basin as a whole. Part two presents briefly the data for each of the several sub-basins of the major basin, including a list of projects now known to be needed for water pollution control.

Since the summary reports are based on data which are now readily available, these reports do not discuss or evaluate the most advantageous water uses as they are related to pollution control. Such considerations will be included as a part of the comprehensive water pollution control programs.

The deficiencies in data and the gaps in information indicated in these summary reports are as significant as the presentation of available facts and statistics. They indicate the work which still needs to be accomplished by water pollution control authorities for the preparation of comprehensive programs.

Data and knowledge now available are sufficient, however, to permit the immediate solution of many of the pollution problems within the Great Basin without awaiting the results of additional surveys and studies. The tabulations of pollution abatement projects which are included in Part Two of this summary report represent presently known needs. However, future studies and evaluations may result in some changes in the estimations of requirements.

A sincere effort has been made by all who contributed to this report to present a fair picture of the complex water pollution problems in the Great Basin and to present reasonable conclusions and recommendations. It is our hope that this report, as a step in the cooperative development of an ultimate comprehensive pollution control program, will help in safeguarding the water resources of the Great Basin.

Leonard A. Scheele

Surgeon General

ACKNOWLEDGMENTS

The Public Health Service wishes to acknowledge the cooperation and assistance of those agencies and individuals that have contributed to the preparation of this report on the Great Basin.

The Great Basin includes portions of five States - California, Idaho, Nevada, Utah, and Wyoming. In each of these States the State Department of Health is the currently* designated "State water pollution agency," for purposes of the Federal Water Pollution Control Act. Accordingly, the base data used in the preparation of the report were provided by the respective State Health Departments which also reviewed the report and provided the respective clearances for its release.

Although notable changes were made in 1949 in the California water pollution control legislation, primary reliance upon the assistance and cooperation of the State Department of Public Health was essential in view of the timing of events and the circumstances involved. The 1949 California legislation established a State Water Pollution Control Board and nine Regional Water Pollution Control Boards. Further, the term "pollution" in this legislation is limited to cover any impairment of quality of water that will interfere with a beneficial use but will not cause an actual hazard to public health. An impairment of water quality to a degree which causes a hazard to public health is called a "contamination." State and local health departments are charged with the control of contamination, and Regional Water Pollution Control Boards have jurisdiction over pollution.

Appointment of the Regional and State Water Pollution Control Boards, establishment of their respective offices, selection and appointment of full time staff members, and implementation of the legislative provisions, even though effected with dispatch, required considerable time. Accordingly, the Bureau of Sanitary Engineering of the State Department of Public Health provided data and necessary clearance from California for presenting the report. Furthermore, the drafts of the sections dealing with six Sub-Basins lying wholly or partly in California were referred as completed to the Regional Water Pollution Control Boards concerned for review, with a request for comments and such clearance as the respective Boards felt authorized to extend under the provisions of the California law. The review and clearance of Federal agencies concerned with water use programs were also obtained.

Federal agencies from which assistance was obtained include the Corps of Engineers, Department of the Army, and the Fish and Wildlife Service, Bureau of Reclamation, Geological Survey, and National Parks Service, Department of the Interior.

Finally, there is acknowledged the assistance of other Federal and State agencies and individuals interested in water resources development and conservation, who have contributed information through many sources.

*July 1, 1950. As of March 30, 1951, the California State Water Pollution Board was designated as the "State Water Pollution Control Agency" for the purposes of the Federal Water Pollution Control Act.

SUMMARY

In this report a review is presented of the physiographic features of the Great Basin, of the current uses of its water resources, and of the general characteristics of these waters. An estimate is given of the principal municipal and industrial pollution loads of the Basin, of the adequacy of existing treatment facilities, and of the need for new treatment works as well as for additions and extensions to existing facilities (tables I and II). Attention is given to the major water uses and needs for conserving natural supplies in different drainage areas of the Basin, to the sources of and damages from water pollution, to information needed for adequate pollution control, to benefits anticipated from control measures, and to Basin problems involving State, interstate, and international regulation.

The Great Basin comprises about 184,000 square miles of predominantly desert area extending approximately 675 miles in a north-south direction from the Columbia River Basin to the Mexican border, covering most of Nevada, the western part of Utah, the eastern portion of California, and small parts of Idaho and Wyoming. Situated between the Cascade, Sierra Nevada and San Bernandino Mountains on the west and the Rocky Mountains and the Colorado River Plateau on the east, the Great Basin includes enormous deserts, numerous individual mountain ranges, and several brackish and highly saline lakes.

Characteristically, the climate varies widely in temperature between summer and winter and between day and night. In general, annual precipitation is limited resulting in widespread desert aridity and large acreages of unproductive land. Most of the rainfall is in the mountain areas in the western and northeastern parts of the Basin, giving rise to the main water supply which is utilized with increasing effectiveness by water diversions and irrigation projects. Summer rainfall ranges from about zero in the south to as high as 5.5 inches in the northern areas. The location of centers of population and industrial concentration is determined, largely, by the water supply. For this reason any future economic expansion undountedly will be in the Great Salt Lake area of Utah and the fertile agricultural valleys of western Nevada and southeastern California.

The 1950 population of the Great Basin is approximately 938,000. There are seven cities that have over 11,000 people. The heaviest populated sections are: The Wasatch Front of western Utah, the Salton Sea area of southern California, and the Lake Tahoe, Truckee and Carson Rivers area of western Nevada. These are the main agricultural regions of the Basin, being exceptionally productive due to irrigation practices.

Current shortages of water for domestic and irrigation purposes explain the interest and economic importance attached to the conservation and efficient utilization of water throughout the Basin. In general, domestic and industrial water uses inside the Basin are of secondary importance, amounting to about 300,000 acre-feet annually, the greatest usage being in the Salt Lake City area of Utah. About 318,000 acre-feet of water from the Owens River area in the Basin are exported annually to Los Angeles for domestic and industrial uses. On the other hand, about 3,000,000 acre-feet of Colorado River water are imported into the Basin annually. The greatest consumptive use of water in the Basin is for the irrigation of approximately 2,000,000 acres annually, the amount of water used being about 5,700,000 acre-feet per year.

There are about 64 hydroelectric power plants in the Great Basin that have an installed capacity of about 300,000 kilowatts. Approximately 90 per cent of these installations are in eastern Utah.

Waters of the Basin are used extensively for recreational purposes. Nearly 4,000,000 people in southern California alone look to the mountains of the western border of the Great Basin for fishing, skiing, hunting, swimming, and boating. The streams in the Salt Lake City area also are widely used for recreational purposes.

Estimates indicate that wastes with a population equivalent of 1,765,000 reach the watercourses of the Basin and additional wastes with a population equivalent of 59,800 persons are discharged to land. These wastes are produced by 142 sewered communities and 95 of the 137 industries, which have separate discharges for which information is available. On a population-equivalent basis, one-third of the known organic wastes originate in sewered communities and two-thirds in industrial plants having separate waste outlets.

There are 142 sewered communities in the Great Basin with a connected population of 590,800. Sewage treatment facilities, consisting of 42 primary treatment plants

serving a total population of 88,400 in 43 communities and 59 secondary treatment plants serving a total population of 96,100 have been provided by 82 of the 142 communities. Sixty sewered communities having a total population of 405,600 possess no waste treatment facilities (tables A and C).

Pollution abatement activities have varied throughout the Basin. Thirteen municipal waste treatment plants serving approximately 88,000 persons have been constructed in the post-war period. This represents nearly all of the sewage treatment plant construction since 1940. Although the Basin population increase from 1940 to 1950 was about 195,000, the municipal sewage treatment facilities provided during the decade have a capacity equal to less than one-half of the population growth for the corresponding period.

The extent to which pollution abatement measures for municipal wastes have been adopted varies widely. One hundred percent of the sewered population is served by adequate treatment facilities in the Owens River Sub-Basin, while none of the sewered population is served by adequate waste treatment facilities in the Central Nevada Sub-Basin. The Great Salt Lake Sub-Basin, with only five percent of its sewered population of 327,700 served by adequate waste treatment facilities, is the area where the needs for reduction or elimination of pollution are greatest. Perhaps the most significant information in table I is that 58 percent of the sewered communities in the Basin are provided with treatment facilities as compared to 65 percent for the United States as a whole, and 31 percent of the sewered population is served by treatment facilities in the Basin as compared to 63 percent for the United States. Only 17 percent of the sewered population in the Basin is served by adequate treatment facilities.

Current estimates indicate that treatment projects are required for 92 municipal sources of pollution in the Great Basin. Fifty-eight new sewage treatment plants should be built and 15 existing plants should be replaced. The remaining 19 needed projects consist of enlargements or additions to existing plants. The new and replacement plants needed will provide adequate treatment facilities for 447,200 persons, while the enlargements and additions will be to plants now serving 37,000 persons.

A general cost estimate to indicate the magnitude of these over-all community needs approximates $9,315,000. This estimate is restricted to the initial capital investment for currently needed treatment plants (table G).

Wastes from 137 industrial establishments in the Great Basin are discharged directly to watercourses. Of these 106 are known to discharge organic wastes, 24 discharge inorganic wastes and 7 discharge wastes of an undetermined character. These establishments include agricultural processing plants, mines, mills, smelters, and also chemical and cement plants. Of the 137 industrial plants 77 have provided waste treatment facilities, 54 provide no treatment and the status of pollution prevention measures taken at six plants has not been determined (tables B and D). Fifty-six percent of the industries in the Great Basin are served by waste treatment facilities as compared to 58 percent of the sewered communities (tables I and II).

Cost estimates for currently needed industrial waste treatment projects have not been made because of lack of specific information on the magnitude of operations and the nature of needed remedial measures.

The known requirements for industrial waste treatment include 43 new treatment works and 15 enlargements or additions to existing treatment plants. The requirements for 50 industries have not been ascertained.

The Great Salt Lake Sub-Basin, with 50 sewered communities and 99 industries discharging waste through separate outlets, is the most populated and industrialized part of the Basin. While agriculture continues to be the principal activity in the Basin, the metals industry and manufacturing are expanding rapidly. Water pollution control problems are proportionately more serious. Agricultural expansion and population growth in the Salton Sea Sub-Basin and the Lake Tahoe and Truckee-Carson Rivers Sub-Basin present potential problems in the water pollution control field.

Damages to waters of this sparsely populated Basin are relatively minor and localized. In most of the area where pollution occurs, domestic sewage reaches watercourses below intakes for public water supplies. At one time a water quality problem existed at Reno, Nev., which necessitated construction of a new water treatment plant.

The major pollution damage in the Basin is to irrigation water, used extensively for low-growing vegetables in the Utah part of the Basin. In the area surrounding and near the eastern border of the Great Salt Lake, particularly between Bear River and Salt Lake City, there is a shortage of water and an irregularity of supply. In addition, the water quality in many locations is a potential threat to health and to the economic and recreational development of the area. In the extensive bird refuges of this region, the incidence of bird disease is believed to be increased seriously by polluted water entering the refuges. There is also a recognized disease hazard to human beings due to polluted waters in the refuges.

In this section of the Basin valuable trout streams, such as the Provo River and Chalk Creek, are being degraded by progressive inroads of silt. In general, siltation, due to

loss of soil cover, is a widespread type of pollution in this area.

Local problems have been created by arsenic compounds which have leached out of mine and mill tailings in certain areas. General stream degradation is caused by return irrigation flow which leaches salts from alkali soils in portions of Nevada, Utah and California.

Further studies are needed to supplement existing knowledge of the origin and of the various types of water pollution in the Basin area, and also to provide satisfactory minimum water quality standards for irrigation, recreation, and for aquatic bird refuges. The full extent of the damages to aquatic life and the possible hazards to public welfare by local conditions of municipal and industrial pollution likewise need study. The extent to which the highly saline waters of Great Salt Lake dissipate the harmful effects of the wastes entering the lake is unknown.

The principal benefit that may result to the Basin from pollution abatement is the elimination of the hazard resulting from the use of polluted irrigation water, notably in the Wasatch Front area of Utah. Additional anticipated benefits include improvement and return to use of lake and stream waters contaminated by municipal discharges and by industrial wastes from steel mills, mines, cement plants and agricultural processing establishments. Reduction in the bacterial contamination of water and reduction of taste and odor producing substances may result in substantial savings in water treatment costs.

In general, the people of the Basin are acutely aware of the need for conserving the natural supplies of water. Unfortunately, there exists only a limited understanding of the importance of safeguards for water quality commensurate with its respective uses. Public apathy in such matters is reflected in the absence of comprehensive water pollution control legislation in the States of Idaho, Nevada, Utah and Wyoming.

An important need is recognized by State water pollution control authorities for preproject planning and consultation involving all private, State and Federal agencies as a necessary prerequisite to construction of water resources development projects.

The States of California and Nevada share in the control of water pollution in the Lake Tahoe area. The difficulties experienced in providing adequate waste disposal systems in this important recreational area are recognized by both States and close administrative cooperation has been maintained.

Near the California-Mexico boundary, the Mexican town of Mexicali discharges wastes to the New River that flows into the United States. The International Boundary and Water Commission of the United States and Mexico should encourage coordinated action on the part of Mexico and California in solving this problem.

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Table I.--Great Basin. Summary of municipal sewage treatment plant data from tables A, C, E and G

Sub-basin	Total number of sewered communities	Sewered communities with treatment facilities	Percent of sewered communities with treatment facilities	Total number of treatment facilities	Number of treatment facilities which are adequate	Percent of treatment facilities which are adequate	Total sewered population	Sewered population served by treatment facilities	Percent of sewered population served by treatment facilities	Sewered population served by adequate treatment facilities	Percent of population served by adequate treatment facilities
Northwest Nevada and Northeast California	4	4	100	4	2	50	10,800	10,800	100	4,300	40
Humboldt River	8	4	50	4	0	0	13,095	10,137	77	0	0
Great Salt Lake	50	16	32	16	8	50	324,925	24,575	7	15,450	5
Lake Tahoe, Truckee, and Carson Rivers	16	13	81	12	6	50	68,215	52,654	77	35,612	52
Central Nevada	3	0	0	0	0	0	2,233	0	0	0	0
Sevier River	13	3	23	3	2	67	18,685	3,700	20	200	1
Walker River	4	4	100	4	1	25	5,982	5,982	100	3,000	50
Owens River	4	4	100	4	4	100	5,000	5,000	100	5,000	100
Mojave Desert	23	22	96	22	14	64	41,955	41,655	99	23,855	57
Salton Sea	18	12	67	12	6	50	97,110	30,740	32	9,960	10
Great Basin total	142	82	58	81	43	53	590,800	185,243	31	97,697	17
United States average	--	--	65	--	--	--	--	--	63	--	--

* Excerpt from "Statistical Summary of Sewage Treatment in the United States" (1945).

Table II.--Great Basin. Summary of industrial waste treatment plant data from tables B, D, F, and G

Sub-basin	Number of industries* in sub-basin	Industries having--			
		Treatment facilities		Adequate treatment facilities	
		Number	Percent	Number	Percent
Northwest Nevada and Northeast California	4	3	75	3	75
Humboldt River	4	4	100	4	100
Great Salt Lake	99	54	55	17	17
Lake Tahoe, Truckee, and Carson Rivers	3	3	100	1	33
Central Nevada	0	---	---	---	---
Sevier River	20	6	30	0	0
Walker River	1	1	100	1	100
Owens River	2	2	100	1	50
Mojave Desert	0	---	---	---	---
Salton Sea	4	4	100	1	25
Great Basin totals	137	77	56	28	20

* Industries having separate outlets and discharging wastes directly to watercourse and to land.

CONCLUSIONS

1. Present information indicates the need for waste treatment projects at 92 communities and 58 industries in the Basin.

2. Increasing water demands necessitate the presently needed improvements in the conservation and utilization of the limited natural water resources of this Basin.

3. The water resources of the Basin are used primarily for irrigation, for domestic and industrial purposes, and for recreational activities. Irrigation consumes approximately 5,700,000 acre-feet of water per year, while domestic and industrial uses amount to only about 300,000 acre-feet per year. Over 3,000,000 acre-feet are imported to the Basin annually from the Colorado River, and 318,000 acre-feet are exported annually from the Owens River to Los Angeles.

4. Domestic and industrial wastes, particulate wastes from manufacturing plants, silt from unprotected watersheds, toxic substances from certain mining and milling operations, and alkali salts leached from the land are pollution threats to the water resources of the Basin.

5. With certain exceptions the quality of the water in the Basin is generally satisfactory for current uses. Among the exceptions are: certain domestic supplies, subject to upstream pollution; sewage or sewage contaminated water used for irrigation; areas where soil erosion causes high turbidities detrimental to recreational activities and aquatic life; polluted water sources serving refuges; and toxic materials from mine tailings which endanger livestock watering locations.

6. Principal municipal and industrial pollution loads of the Basin are in the Great Salt Lake Sub-Basin. The population equivalent of wastes which the communities of this Sub-Basin discharge to watercourses is 426,500 or 75 percent of the total pollution discharged by all communities of the Basin. Furthermore the population equivalent of industrial organic wastes of this Sub-Basin is 1,050,000, or 87 percent of the Basin total for known organic waste discharged from industries having separate waste outlets.

7. The most likely areas of future growth and need as far as pollution control is concerned are the Great Salt Lake Sub-Basin, the Salton Sea Sub-Basin, and the Lake Tahoe and Truckee-Carson Rivers Sub-Basin.

8. There are gaps in the information needed by the pollution control agencies, particularly in regard to industrial wastes, to aid them in the location of sources of pollution, evaluation of damages to water resources, determination of desirable water quality criteria, establishment and administration of minimum regulations for disposal of wastes, and supervision of waste treatment plant operation.

9. Benefits which may be expected to accrue from pollution abatement in this Basin include: elimination of health hazards which may result from use of contaminated sources of domestic and agricultural water supplies; reduced water treatment costs; economic gain by utilization of reclaimed waste water; protection of fish and wildlife, and preservation of existing and development of additional recreational areas and activities.

10. Public awareness of the benefits accruing from water pollution control and support for necessary control activities are found in only a few areas of the Basin.

11. Water resources development projects which determine principal water uses or which change stream flow conditions will influence the requirements prescribed by pollution control authorities for wastes discharged to these water resources.

12. Surface drainage crossing the Mexico-California boundary and such drainage crossing State boundaries in various parts of the Basin result, respectively, in international and inter-state interest in the use of these waters and concern over pollution discharged to them.

13. In California comprehensive water pollution control legislation was recently enacted; in the other four States in the Basin legislative provisions relating to water pollution control are scattered among various State statutes. There is strong interest in at least two of these States for the development and consideration of new comprehensive legislation in this field.

RECOMMENDATIONS

1. Those municipalities and industries which have studied their waste treatment problems and have developed specific programs for solving them and those for which requirements have been prescribed by State pollution control authorities should proceed at once with construction of facilities for control or treatment of their wastes.

2. Comprehensive investigations should be carried on in the Basin by State and local agencies to fill the present gaps in information on pollution sources and damages therefrom so that in prescribing requirements for any particular condition of pollution the responsible agencies may have the advantage of this region-wide knowledge of the problems and needs.

3. A particular effort should be made by local, State, and Federal agencies concerned with water pollution control to acquire adequate information on industrial waste discharges.

4. Research in technical problems of disposal of sewage, garbage, and industrial wastes should be continued in those States where such research is under way. The remaining States of the Basin might profitably institute research into the specific phases of waste disposal which are of most significance to them.

5. Public information programs should be expanded and strengthened through cooperative effort by local, State and Federal governmental agencies and civic lay groups to inform the people of the Basin of specific needs for pollution control through waste treatment, in order to gain public support for conservation of the water resources of the Basin.

6. Construction of reservoirs and other waste resources development projects should be preceded by a careful analysis of their probable effects on water quality and waste treatment requirements in relation to proposed water uses.

7. The present informal cooperation between the Nevada State Health Department and the California Department of Public Health with regard to the water pollution control problems in the area of Lake Tahoe should be strengthened and extended to include participation by the Lahontan Regional Water Pollution Control Board of California.

8. The International Boundary and Water Commission of the United States and Mexico should seek to bring about coordination of activities of Mexico and California on the Mexicali and Calexico sewage disposal problem, in order to secure joint action and a reasonable solution of this international problem.

9. Consolidation and strengthening of existing State water pollution control legislation should be undertaken where necessary by the States of the Great Basin in order to develop an effective Basin-wide program for pollution control.

LOCATION MAP

Great Basin Drainage Basin

GENERAL DESCRIPTION

Historical Background

The Great Basin comprises the wide, predominantly desert area covering most of Nevada, part of Utah, the eastern section of California, and smaller portions of Idaho and Wyoming. This area was named the Great Basin by Captain John Fremont in 1843 because most of the known streams in it were believed to lose themselves. The early immigrants to California overcame this arid and desolate barrier, charted arteries of transport, and unearthed valuable mineral treasures. As early as the mid-sixteenth century, Mexican explorers penetrated the Great Basin presumably as far north as southeastern Utah. In 1776, Mission Fathers from Santa Fe Mission in New Mexico traversed a large part of Utah while searching for a route to the California missions. These explorers were among the first white men to visit the northern periphery of the Great Basin.

In 1847, Brigham Young established the first permanent settlement in Great Salt Lake Valley, but it was not until 1896 that Utah became a State of the Union. The interim between the forties and the nineties witnessed historic struggles, defeats, and successes for new settlers amidst the hazards of rugged pioneering conditions punctuated by Indian wars and adverse economic conditions. This erratic era of migration and exploration was indluenced by the nature of the climate and by the presence or absence of water and mineral wealth. Favorable soil and available water supply encouraged an early agricultural development in the Great Salt Lake area known as the Wasatch Front. Further west the turbid, green, barren-banked Humboldt River, last discovered of the American rivers, served well the desert-weary immigrants and although to them about the most necessary river in America, it was the most hated. "Down the Humboldt to Frenchmen's Ford" was the route followed by early wagon trains, trappers cattlemen, and colorful Basque sheep outfits. Frenchmen's Ford, now Winnemucca, remains a key point in Northern Nevada history.

Another historically famous watercourse of the Great Basin is the Carson River. On this river Ragtown, now called Letteville, was an oasis or resting place for east-west travellers. Other landmarks in the late nineteenth century history of this desert area are Hamilton, Ely, McGill, Tonopah, Virginia City, and Goldfield, important mining centers; Carson City, home of Mark Twain; Comstock Lode, the most productive gold and silver spawning veins of the region; Pyramid Lake, discovered in 1844 by Captain John Fremont; and Lake Tahoe, described by Mark Twain as "the fairest picture the whole earth affords."

The south portion of the Great Basin includes barren, desert mountains and arid, lowland desert covered in geologic times by a northern extension of the Gulf of California, a remnant of which remains in the form of the Salton Sea. Exploration of the area started as early as 1540, when Spanish explorers sailed up the Colorado River and migrated eastward into the Colorado Desert. The Spanish land route across the desert later became the southern Emigrant Trail and the Butterfield State Route that crossed into the northeastern part of San Diego County to Warner Pass and San Diego. Since 1900 extensive irrigation projects have transformed large acreages of the historic desert landscape into highly productive vegetable cover.

The honor of being the first Bureau of Reclamation dam in the nation belongs to the Lahontan Dam on the Carson River commenced in 1903. Since then, irrigation projects have greatly increased in the availability of water supplies and determined trends of economic and social development over such populated parts of the Great Basin as: the Wasatch Front in Utah; Imperial and Coachella Valleys in California; and the Walker, Truckee and Carsor River Valleys in Nevada.

Physical Description

The Great Basin embraces the widespread, desert region of the West. It has an area of about 184, 370 square miles and extends approximately 675 miles in a north-south direction between the Columbia River plateau and the Mexican border. The Cascade, Sierra Nevada, Tehachapi, San Gabriel, San Bernardino, San Jacinto and Laguna Mountains bound the Basin on the west. On the east and southeast it is bordered by the Rocky Mountains (Wasatch Range) and the Colorado River plateau. Within this vast aggregation of basins of interior drainage are numerous mountain ranges commonly 50 to 75 miles in length and from six to 16 miles in width, rising from 3,000 to 5,000 feet above the basin floors and from 7,000 to 10,000 feet above sea level. In some of the basins, lakes exist with waters either brackish or exceedingly salty. Great Salt Lake (area around 2,000 square miles) is the most notable example of a saturated brine water on the North American continent.

In the southwestern portion of the Great Basin there is a long north-south trough called Death Valley which is 276 feet below sea level, the lowest land area within the continent of North America. Here are to be found many topographic features that characterize desert landscapes, including playas, salinas, steep-faced shrinking mountains, alluvial fans, and sand dunes. Throughout the Great Basin there are areas of sand dunes that constitute the most common topographic features in lowlands bordering the ranges. One dune situated north of Winnemucca, Nev., is 40 miles long, from 8 to 10 miles wide, and about 75 feet thick.

The principal closed water system in the southern section is Salton Sea, formed in 1905 by a break in the bank of the Colorado River that flooded the Salton trough to a depth of 67 feet and covered an area of 440 square miles.

In the geologic structure within the Great Basin a period of mountain-making is recorded in the early post-Jurassic time and another period of mountain growth during early Tertiary time when the physiographic evolution of the present day ranges was begun. Both folding and faulting occurred and numerous north-south ranges were formed. Faulting has continued through Tertiary and Quarternary time and is probably going on today in the Basin.

Notable ancestral lakes of the Great Basin are Lake Bonneville and Lake Lahontan. Lake Bonneville, the forerunner of Great Salt Lake, was about 1,000 feet in depth with an area of over 20,000 square miles. Its waters were fresh for it had an outlet to the Pacific Ocean by way of Red Rock Pass, Snake River and the Columbia River. Climatic change to an arid climate has reduced the surface area to the confines of Great Salt Lake which has an average depth of 15 feet. Another lake, having a history similar to that of Lake Bonneville is Lake Lahontan, situated in western Nevada at the east base of the Sierra Nevada. The shrunken remnants of that lake are Honey, Pyramid, Winnemucca, North Carson, and Walker Lakes and several smaller bodies of water.

Typically, the climate has a wide range in temperature between summer and winter and between day and night. Minimum recorded temperatures are as low as -50°F. Precipitation is heaviest through the eastern and more mountainous sections, occurring during the winter months in the form of snow. Summer rainfall ranges from practically zero in the south to as high as 5.50 inches on the average for the period May-September in the northern part of the Basin.

Economic Development

The land-resource types are usually well defined on account of abrupt changes in topography, soils, and vegetation. Some of the basins contain lakes, others are grass-covered lowlands, and some are barren desert wastes. Rainfall is the prime determiner of soil cover and, since the greater part of the Great Basin is in the rain shadow area of the Sierra Nevada, arid conditions are widespread. The lands suitable for farming are situated in the valleys, the timbered range lands are mainly in the high mountains, and the untimbered range lands comprise other areas which are rough and unsuitable for farming. The extent of waste or almost entirely unproductive land is comparatively large, including desert salt flats and barren mountain areas. In some mountainous sections where rainfall is heavy and the soils moist, the vegetation is dense. Grasses and sedges predominate in moist valley bottoms, while sagebrush, greasewood, shadscale, and various hardy grasses and weeds grow in the drier soils of the untilled valleys and lower mountain slopes. Deciduous trees such as cottonwoods, maples, and willows grow mainly along the watercourses. Coniferous trees including alpine fir, Douglas fir, Engleman spruce, and western pines grow mainly in the high mountains.

The 1950 population of the Great Basin is approximately 938,000 and the principal cities are Salt Lake City (181,718), Ogden (56,910), Reno (32,378), Provo (28,899), Logan (16,802), El Centro (12,481) and Brawley (11,885). The main areas of population are: the Wasatch Front, Utah, the agricultrual and industrial heart of the State; the Salton Sea area of Southern California that includes the agriculturally famous Imperial and Coachella Valleys, which exceed all other parts of the United States in the production of alfalfa and flax; and the Lake Tahoe, Truckee and Carson Rivers area in western Nevada where agricultural and recreational activities of the State are centered.

The important industrial area of Utah between Ogden and Provo includes the Geneva Steel Plant of the U. S. Steel Corporation, the largest steel plant west of the Mississippi River. The mining and smelting of nonferrous metals in this area is of national significance. Several important military installations widely scattered throughout the Basin contribute to its economic development.

While relatively limited in extent, agricultural crop lands are exceptionally productive with the aid of irrigation. Principal production centers are: the Wasatch Front area in Utah, the Truckee and Carson River Valleys in Nevada, and the Imperial and Coachella Valleys of California.

The water resources of the Great Basin consist mainly of waters draining from the peripheral mountains. Water diversion and irrigation projects aimed at the appropria-

tion and storage of all available surface supplies commenced in the Great Salt Lake region as early as 1848.

Historically and currently the Great Basin yields rich revenues from oil, gold, silver, copper, iron ore and other minerals mined from the days of the earliest settlers.

USES OF WATER RESOURCES

Domestic and Industrial

Domestic and industrial uses of water in the eastern portion of the Great Basin represent only a small proportion of the total water consumed. However, per capita use in this area greatly exceeds the nation-wide average because of climatic, geologic, and economic factors. Municipal consumption is over 130,000 acre-feet per year, about half of which is derived from surface streams. Small streams draining the western slopes of the Wasatch Range furnish the major portion of this supply. The major municipal use is in Salt Lake City, where the mountain streams in canyons converging toward the city have been developed to provide 42,000 acre-feet per year. Additional water is being made available to Salt Lake City by an aqueduct from Deer Creek Reservoir.

These consumption figures for municipal water use include nearly all of the industrial water users in the eastern portion of the Basin. The cost of developing separate supplies is so prohibitive in this area that, with only a few exceptions, industries purchase water from municipal facilities. Exceptions include a steel plant which has a well supply for cooling and quenching, but must augment this supply with water purchased from Salt Lake City, and several copper concentration mills which have developed their own surface sources. The latter industries may use approximately 100,000 acre-feet per year.

Domestic and industrial water supply use in the central portion of the Great Basin, including the Humboldt River and Central Nevada Sub-Basins, is relatively unimportant as the population of this vast area of 54,470 square miles is less than 25,000. These uses are of greater importance in the western portion of the Great Basin, particularly in the Reno, Nev., area and the Imperial Valley of California which are larger population centers and where there is greater industrial activity. Water from the Owens River and the Mono Lake Basin is a major source of domestic and industrial water supply for the Los Angeles Metropolitan Area, about 318,000 acre-feet of water is exported to Los Angeles each year.

Agricultural

By far the greatest consumptive use of water in the eastern portion of the Basin is for irrigation. The total and partial irrigation of the 1,153,000 acres now irrigable consumes approximately 2,400,000 acre-feet per year. Privately developed reservoirs serve 78 percent of this land. Another 17 percent is served jointly by private and Federal projects, while the remaining five percent is served wholly by Federal projects.

This eastern portion of the Basin uses approximately 2,630,000 acre-feet of water per year for all purposes (domestic, industrial, and agricultural), about 20 percent of which is derived from ground waters, including springs and artesian wells. Approximately 69,000 acre-feet are imported from the Colorado River System and 5,000 acre-feet from the Columbia River system each year. Only a few thousand acre-feet of water are exported from the eastern portion of the Basin.

Irrigation and other agricultural water uses in the central portion of the Great Basin are relatively unimportant, although there is some irrigated agriculture along the Humboldt River and its tributaries and isolated farms and ranches throughout the area depend upon the meager ground water supply. Irrigation is the major water use in the western portion of the Great Basin. Over 600,000 acres of land are irrigated in the Imperial Valley of California, all with water imported from the Colorado River. Principal crops are winter vegetables, alfalfa and sugar beets. The Truckee, Carson and Walker River Valleys near Reno are the most highly developed agricultural areas in Nevada. The total irrigable acreage is estimated to exceed 100,000, and the principal crops are alfalfa, irrigated pasture, small grain, truck crops, and deciduous fruits. There are other smaller irrigated areas in the vicinity of Goose Lake and Middle Alkali Lake in Northern California, and in Antelope Valley and the Mojave River Valley in Southern California.

About 2,000,000 acres in the Basin are being irrigated with approximately 5,700,000 acre-feet of water each year. An additional 300,000 acre-feet are used annually for domestic and industrial purposes. Although over 300,000 acre-feet are exported from the Basin each year, over 3,000,000 acre-feet are now imported yearly from the Colorado River Basin. Thus, only a little over one-half of the water used or accounted for originates in the Basin. Plans for greater development of Basin supplies are under consideration, but the greatest hope for additional supplies lies in the development and transmountain diversion of water from the headwaters of the Colorado River.

Power Use

Hydroelectric power development has reached its optimum in the eastern portion of the Basin. The 56 existing plants have about exhausted the practical sites in this area. The installed capacity of the 56 plants is 183,726 kilowatts, but a large portion of this power is available only during times of high water. There are also five small power plants on the Truckee River in the western portion of the Basin which generate 10,000 kilowatts and three plants on the Los Angeles aqueduct in the Owens Valley which generate 100,000 kilowatts.

Recreational

Recreational uses of the water resources in the Great Basin include: boating and swimming on the Sierra Nevada lakes and certain desert lakes such as Great Salt Lake; camping, picnicking and horseback riding in widespread and desert areas that border the Basin; sport fishing in the cool, clear mountain streams; mountain skiing at the higher elevations; excellent big game hunting in the wooded, peripheral areas with good waterfowl and upland game hunting in some of the lower portions of the Basin; and sightseeing in numerous State and national parks and monuments, forests and preserves.

The Sierra Nevada Mountains are especially famous for fishing and skiing; the Tahoe area for boating, fishing, big game hunting, and skiing; the Wasatch Mountains of Utah for deer and elk hunting and for camping and fishing; the Great Salt Lake for swimming, boating, and hunting; and the fringes of the Mojave and Anza deserts for camping and picnicking. Principal government owned recreational lands represented in the Great Basin include ten national forests, two national monuments, Anza Desert State Park, and the Winnemucca and Bear River Migratory Bird Refuges.

Additional sources of recreation are being provided by water storage reservoirs steadily increasing in number. Their continued and more intensive use aggravates the widely recognized potential hazard to the bacteriological quality of reservoir waters.

Population demands on the recreational facilities of the Great Basin area are exceedingly great and promise to increase. In 1947, more than one million persons are known to have visited the Salt Lake area alone. Approximately four million people in the Southern California area look largely to the Cascade, Sierra Nevada, and Peninsular Range Mountains of the western border of the Great Basin for recreation.

Clearly, proper exploitation of the recreational facilities of the Basin commensurate with the increasing population demands entails constant vigilance and long-range planning directed toward water conservation. Primary water uses in the Basin are indicated on map No. 4.

POLLUTION CONTRIBUTED TO WATER RESOURCES

Available information for municipal and industrial sources of pollution is summarized in tables A and B. In the Basin there are 142 population centers served by sewerage systems having a connected population of 590,800 persons. Ninety-one of these, serving 511,400 persons, discharge wastes with an estimated population equivalent of 563,800 to watercourses and 51, serving 79,400 persons, discharge wastes equivalent to 59,800 persons to land.

In addition, there are 137 known industries discharging wastes directly to the watercourses of the Basin. Ninety-five of these industries for which some data are available discharge organic wastes with a total population equivalent of approximately 1,201,200. There are 11 industries producing organic wastes for which data are not available, 24 which produce inorganic wastes, and seven which produce wastes of an undetermined character.

These statistics indicate that the total known sewage and industrial liquid organic wastes as discharged (on the basis of strength or population equivalent) are equivalent to the wastes of about 1,824,800 persons. Approximately 97 percent of these wastes reach the watercourses of the Basin and the remaining 3 percent are discharged to land. It is also important to note that on a population equivalent basis wastes discharged by industry are about twice as great as those discharged from community sewerage systems.

The communities in the Great Salt Lake Sub-Basin discharge wastes with a population equivalent of 426,500 or about 75 percent of the total municipal population equivalent of 563,800 discharged to watercourses of the Basin. The major industrial sources of pollution are also in the Great Salt Lake Sub-Basin where 99, or 72 percent, of the 137 industries which have separate waste discharges are located. Seventy-five of these industries discharge organic wastes which have a total population equivalent of 1,050,000, or 87 percent of the total population equivalent discharged in the Basin by industries which have separate waste outlets.

The known manufacturing industries in this Basin which have separate waste discharges include: food and kindred products (97), textile mill products (2), lumber and wood products (2), chemical and allied products (2), petroleum and coal products (5), primary metal industries (6), fabricated metal products (1), and miscellaneous (8). The non-

Table A. Sources of pollution, municipal

Municipalities*	Sources of pollution (in number of municipalities)	Population served by sewerage system	Amount of pollution discharged to watercourse (in terms of equivalent number of people)**
Having data on pollution load discharged to watercourse*** [2]	91	511,420	563,810
	51	79,380	59,810
Having population data available (data on pollution load to watercourse incomplete or not available)	--	--	Not applicable
Total	142	590,800	--

*Includes incorporated or unincorporated municipalities, other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers; sanitary sewage wastes discharged by industry directly to watercourse.

**Includes industrial wastes discharged into municipal sewage systems.

***In the arid west sewage collection and treatment systems discharge not only to watercourses where pollution of surface waters may be a problem but also to land where pollution of underground waters may occur. Accordingly, sources of pollution are broken down into these two categories and listed as such in this table.

[1] "To watercourses". [2] "To land".

manufacturing industries include: mine drainage (3) and other mining industries (11). Approximately half of these industries provide some type of waste treatment as indicated in table D.

The organic industrial wastes are contributed principally by fruit and vegetable canneries, dairies, meat packing plants and beet sugar plants. Inorganic wastes originate in oil refineries, copper refineries, steel plants, smelting plants and a creosote plant in this Basin. The greater part of this industrial development is in Utah and the streams receiving the greater portion of the load drain to Great Salt Lake. However, there are some cannery and dairy wastes discharged in Idaho and meat packing wastes in Nevada.

The breakdown of numbers of sources of municipal and industrial pollution by Sub-Basins is shown on Map No. 1 entitled "Sources of Pollution." The detailed statistical data concerning sources of pollution in each of the ten Sub-basins are presented in tables A_1 to A_{10} and B_1 to B_{10} in Part II of this report.

Table B. Sources of pollution, industrial*

Industries	Sources of pollution (in number of plants)	Amount of pollution discharged to watercourse (in terms of equivalent number of people)
Producing organic wastes	95	1,201,150
Producing organic wastes	11	Undetermined
Producing inorganic wastes	24	Not applicable
Producing wastes of undetermined type	7	Undetermined
Total	137	--

*Industries having separate outlets and discharging wastes directly to watercourses and to land.

DAMAGES TO WATER RESOURCES FROM POLLUTION

Generally speaking, the scarcity of water in this arid Basin has resulted in great value being placed upon water without equal regard for its quality. Because of the sparse population, intensive nuisance or pollution problems have not generally been experienced. For these and other reasons the treatment of domestic and industrial wastes has lagged, and the damages from pollution are primarily potential rather than existent.

Domestic sewage, fortunately, in most cases reaches watercourses below intakes for public water supplies though there are a few supplies not so well situated. Reno, Nev., takes its supply from the Truckee River below a community from which sewage effluent has discharged to the river on occasion. Extensive recreational development of the watershed area that supplies water to Salt Lake City has raised the question of whether complete treatment of the public water supply is indicated rather than chlorination only, as currently provided.

The greatest potential pollution damage in the Basin is to waters used for irrigation. Many low growing vegetables, notably lettuce, cabbage and celery, are raised in portions of the Basin where irrigation waters may contain sewage. For example, water is diverted from the Weber River below the Ogden sewer outfall during the late summer to augment other irrigation supplies, although at times during this period the stream flow is mostly sewage and complete oxygen depletion is not uncommon. The occurrence of a single epidemic of enteric disease traceable to food crops irrigated with sewage-polluted water could do almost irreparable damage to this agricultural industry.

One rather obvious instance of damage to surface waters can be observed in Provo Bay of Utah Lake. Here industrial and domestic wastes have combined to blight a large area.

In the Bear River Migratory Bird Refuge and the Farmington and Ogden Bay Refuges the incidence of disease is believed to be increased seriously by polluted water entering the refuges. Mortalities of upward to 10,000 birds per year have occurred. Waste from the Ironton Plant of the Geneva Steel Corporation enters Utah Lake causing fish kills. Wastes from a cement plant creating high turbidity enter Lost Creek, tributary to the Weber River, and degrade that habitat for fish. In general, siltation due to loss of soil cover is a widespread cause of pollution in the Great Basin. Many valuable trout streams such as Provo River and Chalk Creek are being degraded by silt.

Toxic materials have leached from mine and mill tailings and endangered livestock in certain portions of the Basin. Alkali salts leached from the soil by natural and irrigation run-off have degraded the lower reaches of streams in Utah, Nevada, and California.

BENEFITS RESULTING FROM POLLUTION PREVENTION AND ABATEMENT

Because pollution abatement activities have not kept pace with municipal and industrial growth, the actual tangible benefits of accomplished pollution abatement in this Basin are primarily of a potential nature. The greatest single Basin-wide benefit which may result from pollution abatement is the elimination of the hazard attendant upon widespread use of sewage polluted irrigation water. The proper treatment and reclamation of domestic and industrial wastes is of great economic significance in this Basin because of its limited water resources.

Other potential benefits are somewhat more localized. Pollution abatement above Stoddard on the Weber River would decrease the public health hazards of using the supply to be developed by the Bureau of Reclamation's Weber Basin Project. Industrial and municipal waste treatment could return a large area of Utah Lake to beneficial use and at the same time remove a serious local nuisance. The proper handling of mining, milling and dredging wastes could reduce siltation and toxic poisoning which have caused stream degradation and fish kills. The removal of organic oxygen-depleting materials would tend to eliminate the conditions conducive to botulism which kills thousands of wildfowl each year in the Great Salt Lake area.

Benefits resulting from control of water pollution are most directly associated with the respective water uses, though there are also indirect but very significant benefits that accrue as, for example, the increase in real estate and property values following control of water pollution.

Examples of benefits that may accrue in the case of public water supplies are reduction in bacteriological contamination and reduction in taste and odor producing substances by control of domestic and industrial waste pollution. Such control lessens the potential disease hazard and permits the delivery of drinking water of satisfactory physical, chemical, and bacteriological quality at a reduced cost for water treatment. In certain instances waste treatment measures spell the difference between feasibility of utilizing a given watercourse for domestic use water supply and the necessity of utilizing an alternative source at a greater distance and, therefore, at a greater cost for development.

The quality required for process water by industry varies according to the products involved. It varies from minimum or no water quality requirements to those that can be met in some cases only by carefully controlled distillation of the raw supply. Generally, where industry uses a watercourse both as a source of supply and as an outlet for its wastes, control of industrial pollution through treatment of waste benefits downstream industry by reducing water-treatment costs. In acheiving pollution abatement, utilization and re-use of by-products formerly wasted may be accomplished to the economic advantage of the industry.

Aquatic life is benefited by pollution control and such control may mean the difference between a profitable and a non-profitable fishery. Similarly, benefits can be shown to accrue from water pollution control for recreation, irrigation and other water uses.

POLLUTION PREVENTION MEASURES IN EFFECT

Table C indicates that 82 of the 142 sewered communities in the Great Basin have provided sewage treatment facilities for their wastes. Forty-three of the communities, with a combined population of 88,400 have provided 42 primary treatment plants; and 39 communities, with a combined population of 96,800, have provided 39 secondary treatment plants. Sixty sewered communities, with a combined population of 405,600 or 69 percent of the sewered population for the Great Basin, have no waste treatment facilities. The Mojave Desert Sub-Basin leads in the number of sewage treatment plants with 22, but the Owens River, Walker River, and Northwest Nevada - Northeast California Sub-Basins lead on a percentage basis with 100 percent of the sewered population served by waste treatment facilities. It should be noted, however, that the total sewered populations for these three Sub-Basins is only 21,800.

As shown in table D 77 of the 137 Basin industrial plants discharging wastes through separate outlets have provided waste treatment facilities, 54 have no treatment facilities, and the pollution prevention measures that have been adopted at 6 plants are undetermined. Map No. 2 shows the number of existing municipal and industrial waste treatment facilities for each of the Sub-Basins in the Great Basin.

Table E indicates that 43 of the 81 municipal waste treatment plants in the Basin are adequate as to design capacity and degree of treatment provided, 35 are inadequate and the adequacy of three is undetermined. The operation of 58 of the municipal treatment plants is satisfacotry, operation of 22 is unsatisfactory and one is undetermined.

Twenty-eight of the industrial waste treatment plants are adequate as to design capacity and degree of treatment provided, 17 are inadequate and the adequacy of 32 is undetermined. Operation of 36 of the industrial waste treatment plants is satisfactory, nine unsatisfactory and 32 undetermined. Information on the poilution prevention measures that have been adopted by many industries in the Great Basin is incomplete and additional studies are required to secure this information.

The following Federal and State financial aid measures are noted because of their significance as pollution prevention measures now in effect:

1. In California the 1946 "Construction and Employment Act," amended to extend to December 31, 1952, made $90,000,000 available to cities and counties for construction of public works. Of the $45,000,000 made available to cities, construction of sewage facilities is given first priority and two-thirds of the $45,000,000 made available to counties can also be drawn upon for construction of sewage facilities in which there is a State interest.

The 1949 Statutes of California (Chapter 1551) makes further financial assistance available to communities for sewerage projects by means of loans from a $1,000,000 State Water Pollution Control Fund administered by the State Water Pollution Control Board.

2. Section 8(a) of Public Law 845, 80th Congress, makes available to the States grants for conduct of investigations, research, surveys and studies related to the control and prevention of water pollution caused by industrial wastes. The financial aid from this source has been particularly helpful to those States in this Basin where State funds for water pollution control activities have been limited or entirely lacking. These grants have greatly stimulated water pollution control work in Nevada and Utah which comprise the greater portion of this Basin.

3. Public Law 352 has made funds available in the form of non-interest bearing loans to communities for planning waste treatment works as well as for other public works. An appreciable number of communities in the Utah portion of the Basin have taken advantage of this legislation to apply for loans for planning waste treatment works.

In California Chapter 1552 of the 1949 statutes directs the Division of Water Resources of the Department of Public Works to investigate conditions of the quality of all waters within the State as related to all sources of pollution of whatever nature and to conduct surveys and investigations relating to the reclamation of water from sewage or industrial wastes for beneficial purposes.

Water pollution control legislation in the States of this Basin varies from recently enacted, comprehensive legislation in California

which sets up both State and Regional Water Pollution Control Boards, to scattered statutory provisions of a limited nature in Utah. The States of Idaho, Nevada, Utah or Wyoming do not have comprehensive water pollution control laws, although in some of these States there is an interest in and active efforts are underway to develop and enact such laws.

Recent progress in providing treatment works in this Basin for both municipal and industrial wastes is shown in table F. In the last four years 13 municipal and eight industrial waste treatment plants have been built. Annual additions have varied from one to six for municipal and one to four for industrial waste treatment works. At this rate it might easily take 20 years to provide the currently needed 73 municipal treatment plants and the 43 industrial waste treatment plants.

Table C.

Existing treatment facilities, municipal

Degree of treatment provided	Number		Population served
	Municipalities*	Plants	
Primary	43	43	88,415
Secondary	39	39	96,828
No treatment	60	--	405,557

*Includes incorporated or unincorporated municipalities, other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers; sanitary sewage wastes discharged by industry directly to watercourse.

Table D. Existing treatment facilities, industrial*

Type industry	Number of plants	Number of industrial plants having:		
		Treatment facilities	No treatment facilities	Undetermined facilities
Manufacturing industries:				
Food and kindred products	97	49	45	3
Textile mill products	2	--	2	--
Lumber and wood products (except furniture)	2	1	--	1
Paper and allied products	--	--	--	--
Chemical and allied products	2	2	--	--
Products of petroleum or coal	5	4	1	--
Rubber products	--	--	--	--
Leather and leather products	--	--	--	--
Primary metal industries	6	4	2	--
Fabricated metal products (except ordnance, machinery, and transportation equipment)	1	--	1	--
Miscellaneous	8	6	2	--
Nonmanufacturing industries:				
Oil production industry	--	--	--	--
Mine drainage	3	1	--	2
Other mining industries	11	10	1	--
Totals	137	77	54	6

*Industries having separate outlets and discharging wastes directly to watercourse and to land.

Table E. Adequacy of existin treatment facilities

Existin treatment facilities	Number	Adequacy with relation to:					
		Capacity			Operation		
		Satis-factory	Unsatis-factory	Unde-termined	Satis-factory	Unsatis-factory	Unde-termined
Municipal	81	43	35	3	58	22	1
Industrial		2[illegible]	1	32	30	[illegible]	32

Table F. Progress in pollution abatement

Year	Municipal		Industrial	
	Plants completed	Design population	Plants completed	Amount of waste treated (in terms of equivalent number of people)
1946	--	--	--	--
1947	1	[illegible]00	1	13,000
1948	2	4,3[illegible]	1	15,000
1949	6	17,250	2	4,500
1950	4	65,[illegible]00	1	49,000

POLLUTION PREVENTION MEASURES REQUIRED

Requirements for treatment of municipal and industrial wastes in the Basin are summarized in table G and the status of projects to meet these requirements is indicated in table H.

The needs set forth in table G and in table I of sub-basin discussions which follow the main part of the report, are based on presently available information. However, further surveys, studies, etc., may result in some changes in the project requirements now shown.

Considering the requirements for new municipal plants (58) and replacement of existing plants (15), there is a need for 73 new treatment works to serve a population of 447,200. Enlargements or additions are required for 19 existing plants serving 37,000 persons. In comparison there are now in the Basin 81 municipal treatment plants serving 185,300 persons. If allowance is made for the population now served by inadequate treatment works, the job of treatment of community wastes is only about one-fourth accomplished at present.

Of these municipal projects for which requirements are indicated, 37 are for cities of over 2,000 population. Seven of these will serve populations ranging from 10,000 to 90,000 with one serving a population of over 158,000. Thirty-five projects will serve populations under 1,000, 16 of which are under 500. At 46 places with a total population of over 101,200, projects are not now required. The needs at four places with a population of 6,300 have not been ascertained.

Waste treatment requirements have been estimated for 86 of the 137 industrial plants which are known to have separate waste outfall sewers. On the basis of present information 43 of the 86 require new facilities, 15 require enlargements or additions, and 28 have no requirements. Requirements are undetermined at the remaining 51 industrial plants.

In table H the currently available information on the status of projects to abate water pollution is presented. At 21 municipalities some specific action is under way for provision of treatment works. At four other places abatement orders have been issued. No formal action has been taken at 57 places and information is not available on the status of 14 other places. With regard to industrial waste treatment, information is not available on the status of 19, and no formal action has been taken by 87 industrial plants. Final plans have been approved for one treatment plant and one other plant is under construction.

Of the 81 municipal waste treatment plants in the Basin, 22 are considered to have operational shortcomings. This represents over 27 percent of the existing treatment facilities and provides a fertile field for effective though inexpensive pollution abatement activities.

The greatest needs for pollution abatement activities now exist in the Great Salt Lake Sub-Basin, Future growth and potential waste treatment needs are expected to be the greatest in this Sub-Basin, the Lake Tahoe-Truckee-Carson Rivers Sub-Basin, and the Salton Sea Sub-Basin.

The peculiar situation encountered in the Lake Tahoe area presents the need for close cooperation between the States of California and Nevada. A combination of topographic and geologic conditions combine to make individual waste disposal systems difficult for resorts, hotels and large residences. Strict restrictions on discharges to Lake Tahoe are justifiably enforced in both States. These factors combine to create a situation where continued close cooperation between the States is necessary.

International cooperation is necessary in the southern part of the Basin, where at present sewage from Mexican towns is discharged to streams which flow into California. Through the interest of the International Boundary and Water Commission of the United States and Mexico, and existing agency, such cooperation for joint solution of pollution problems can be secured.

Strengthening of public information programs to apprise the public as to the need for treatment of municipal and industrial wastes and to thereby gain its support in pollution abatement activities, and the development of comprehensive State water pollution control legislation appear to be two important steps that should be taken to bring about construction of needed facilities.

Map No. 3 entitled "Projects Required", shows the needs by Sub-Basins for new treatment works, for replacements, and for additions or enlargements. The detailed statistical data concerning sources of pollution in each of the ten Sub-Basins are presented in tables G_1 to G_{10} and H_1 to H_{10} in Part II of this Report.

Based upon the requirements tabulated in table G and in the tables I of the Sub-Basin reports, the estimated cost for construction of the municipal projects is $9,315,000.

This estimate for needed municipal treatment works was developed by making broad assumptions regarding the degree of treatment needed, growth and future needs, and the current value of existing installations, and then applying a per capita cost ranging from $10 to $60, depending on the size of the community and the interpretation of other factors. Accordingly, these estimated costs are approximate and were developed to show the general magnitude of over-all needs rather than to secure a specific cost figure. It must be emphasized that these estimates are for initial investment for treatment works projects only and do not include needed collection systems, interceptors planning, etc.

Recognizing that these expenditures will take place over a number of years, the estimated costs will be increased due to added factors. These include additional annual obsolescence and rehabilitation requirements, needs of communities installing new sewer systems, normal population increases and industrial expansion, as well as allowance for presently undetermined needs.

Cost estimates for industrial requirements have not been made because of lack of specific information on the magnitude of operations and the nature of needed remedial measures. The varied approaches to industrial waste control make estimates of cost unreliable without a detailed investigation of each specific case.

Table G. Requirements for municipal and industrial waste treatment plants*

Requirements (**)	Municipal		Industrial
	Number	Population served by facilities	Number
New Plant	[1]58	[1]402,122	43
Enlargement or additions to existing plant	19	37,044	15
Replace existing plant	15	45,074	0
No project required	[2]46	[2]101,232	28
Undetermined	4	6,328	[3]50

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

**For a listing of individual project needs refer to table I included at the end of each sub-basin discussion following the main part of this report.

[1]Includes one community of 1,000, which is not sewered and which is not included as a source of pollution in tables A and C of this report.

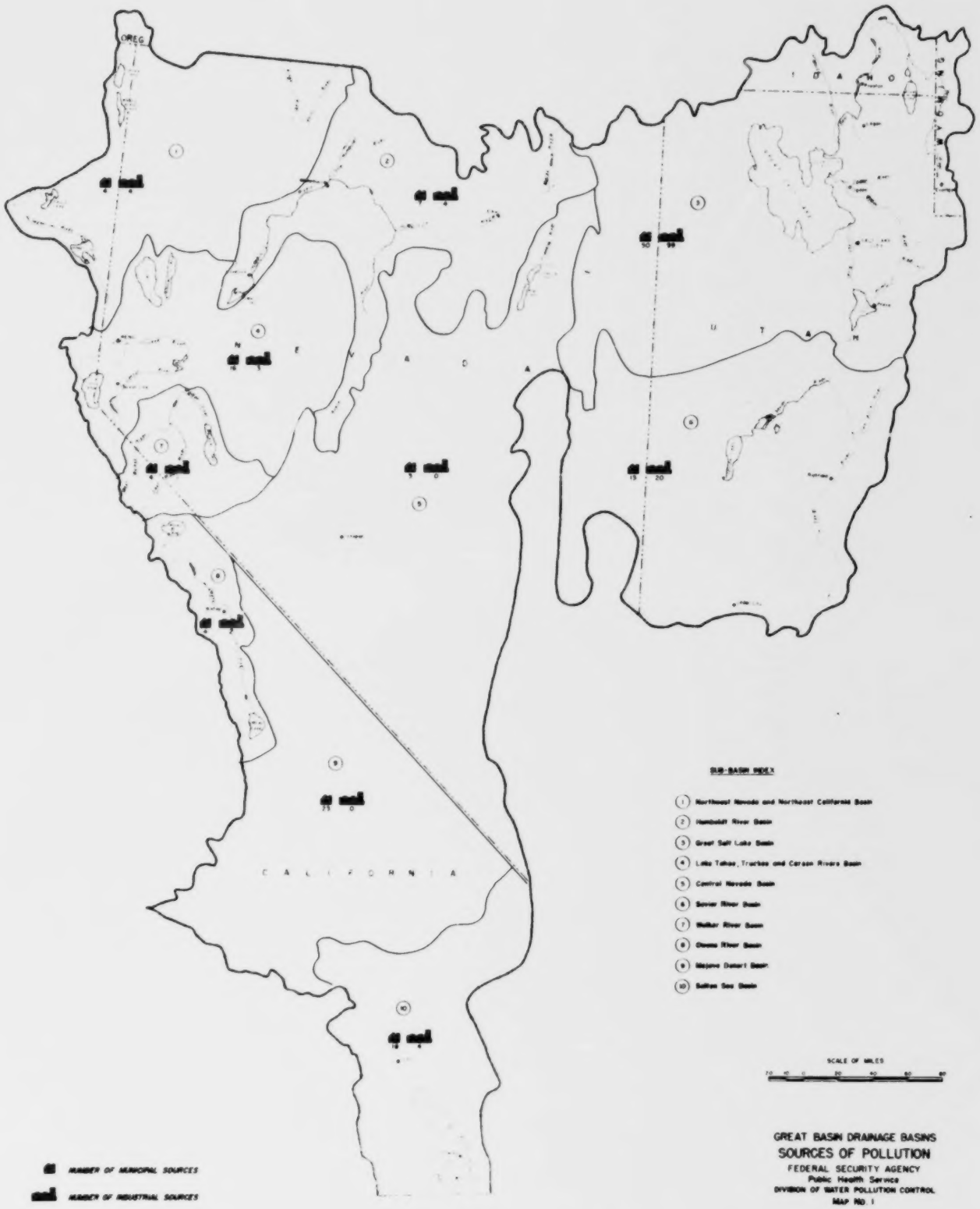
[2]Includes three communities which do not have sewage treatment facilities.

[3]One installation will serve the joint outfall of two industrial plants.

Table H. Status of treatment works project to abate pollution, July 1, 1950

Status of project	Number	
	Municipal	Industrial
No formal action	57	87 *
Abatement ordered	4	--
Plans under preparation	14	--
Final plans approved	1	1
Construction awaiting financing	3	--
Under Construction	3	1
Status undetermined	14	19

*One installation will serve the joint out - fall of two industrial plants.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U T A H
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SUB-BASIN INDEX
1 Northwest Nevada and Northeast California Basin
2 Humboldt River Basin
3 Great Salt Lake Basin
4 Lake Tahoe, Truckee and Carson Rivers Basin
5 Central Nevada Basin
6 Sevier River Basin
7 Walker River Basin
8 Owens River Basin
9 Mojave Desert Basin
10 Salton Sea Basin
SCALE OF MILES
NUMBER OF MUNICIPAL SOURCES
NUMBER OF INDUSTRIAL SOURCES

GREAT BASIN DRAINAGE BASINS
SOURCES OF POLLUTION
FEDERAL SECURITY AGENCY
Public Health Service
DIVISION OF WATER POLLUTION CONTROL
MAP NO. 1

23-a

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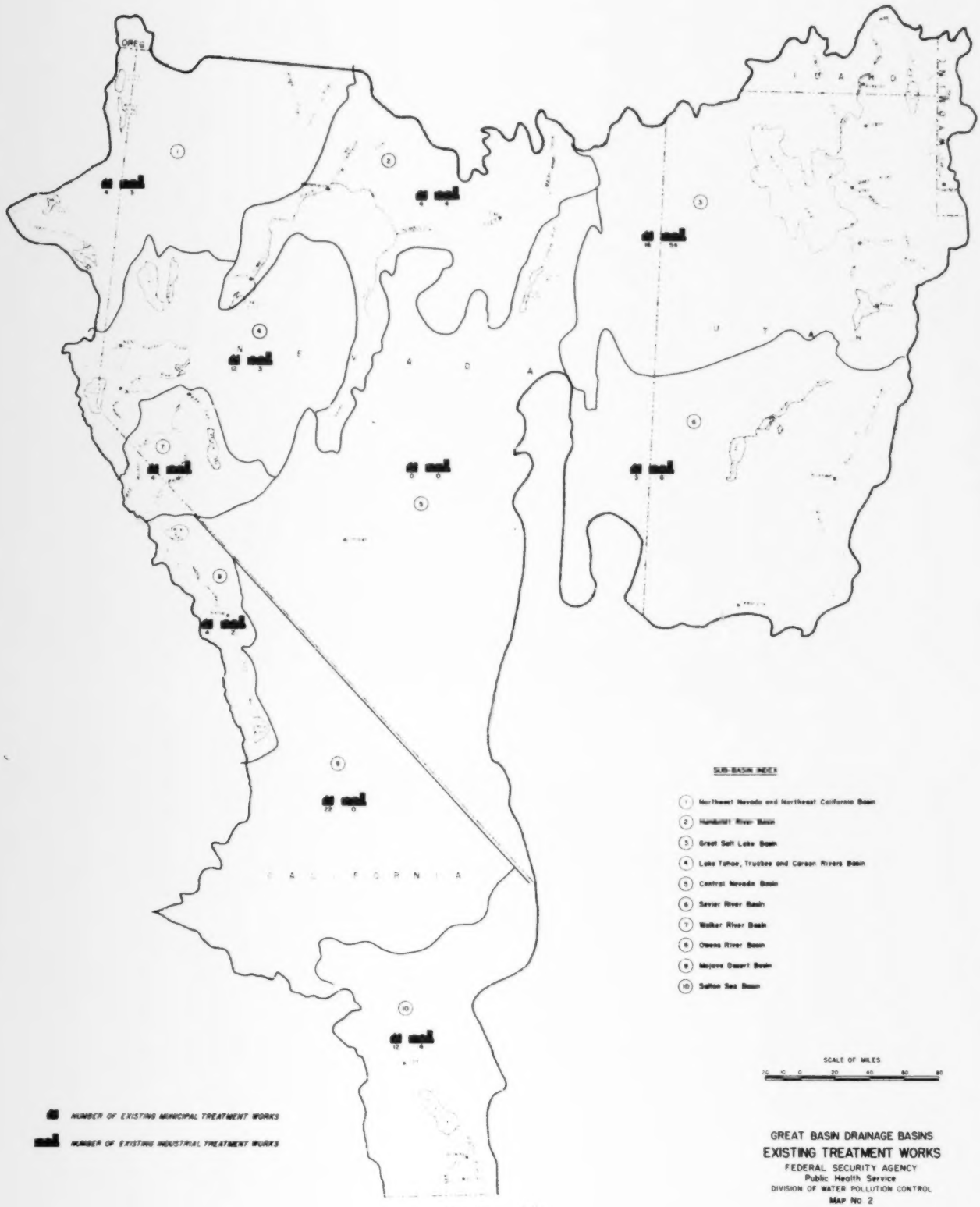
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C A L I F O R N I A
SUB-BASIN INDEX
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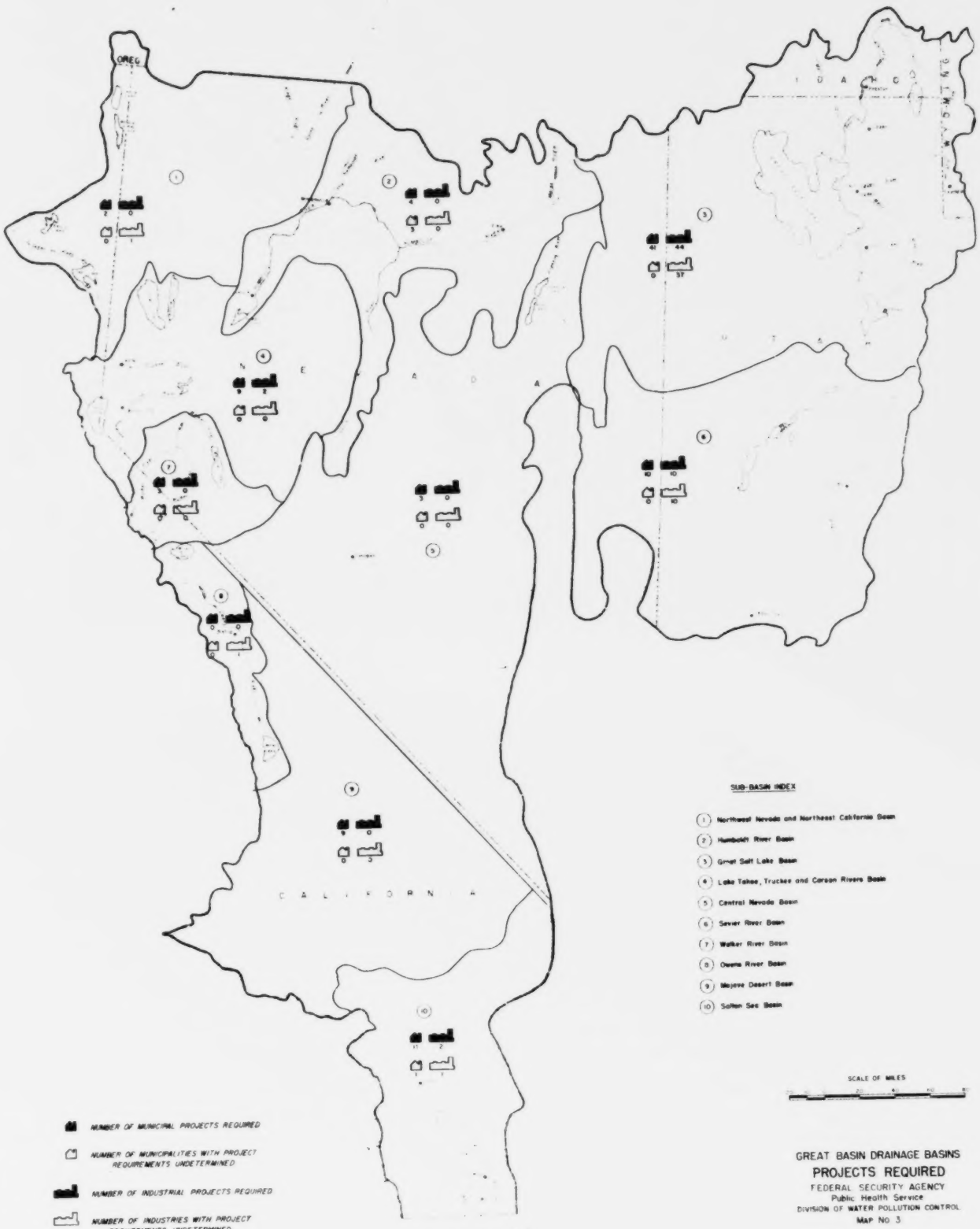
8 Owens River Basin
9 Mojave Desert Basin
10 Salton Sea Basin
SCALE OF MILES
NUMBER OF EXISTING MUNICIPAL TREATMENT WORKS
NUMBER OF EXISTING INDUSTRIAL TREATMENT WORKS

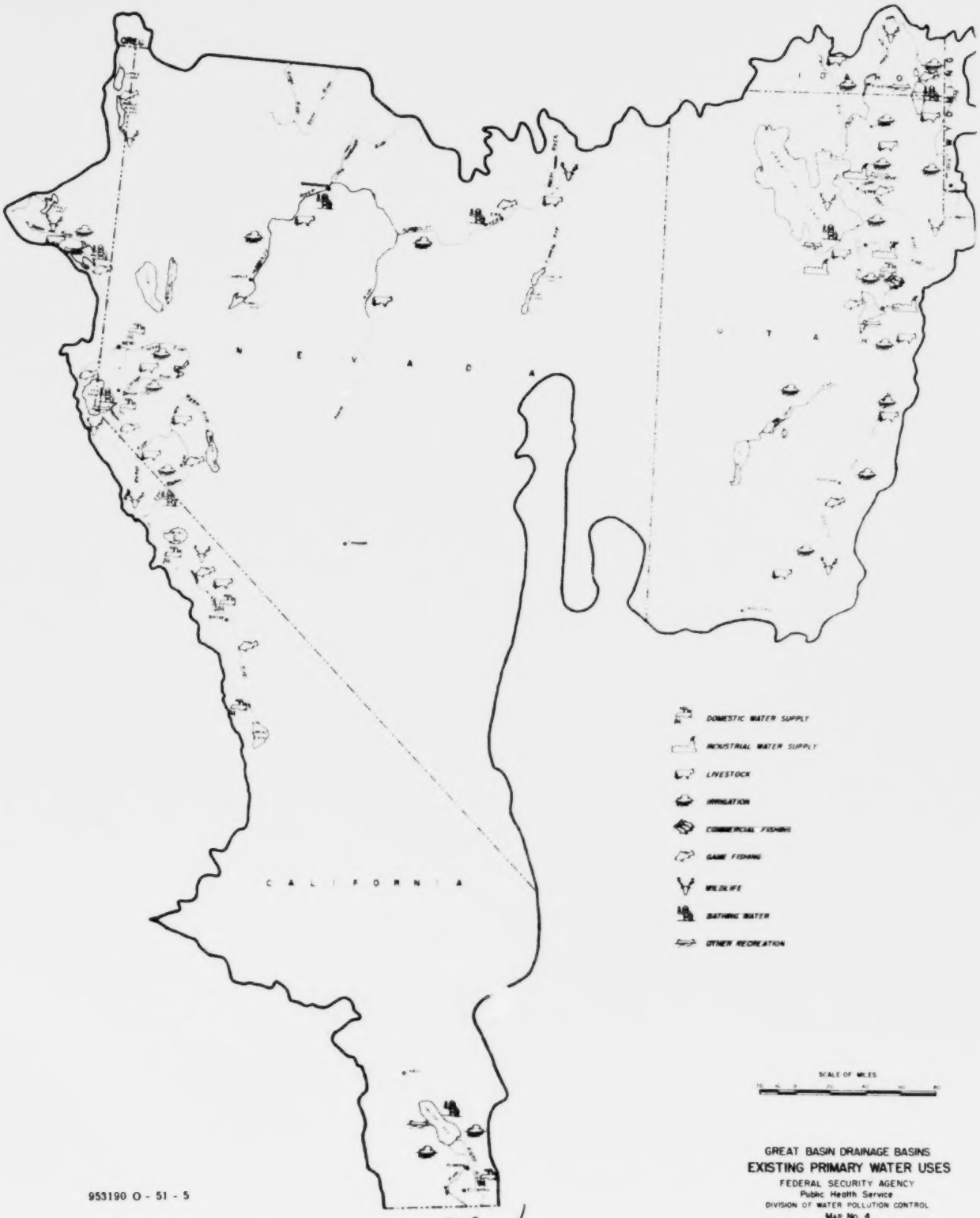
GREAT BASIN DRAINAGE BASINS
EXISTING TREATMENT WORKS
FEDERAL SECURITY AGENCY
Public Health Service
DIVISION OF WATER POLLUTION CONTROL
MAP NO 2

23-F



GREAT BASIN DRAINAGE BASINS
PROJECTS REQUIRED
FEDERAL SECURITY AGENCY
Public Health Service
DIVISION OF WATER POLLUTION CONTROL
MAP NO. 3

23-C



GREAT BASIN DRAINAGE BASINS

EXISTING PRIMARY WATER USES

FEDERAL SECURITY AGENCY
Public Health Service
DIVISION OF WATER POLLUTION CONTROL
Map No. 4

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23-1

SUB-BASIN REPORTS

NORTHWEST NEVADA—NORTHEAST CALIFORNIA SUB-BASIN

Description and Economic Development

The Northwest Nevada and Northeast California Sub-Basin covers an area of approximately 16,600 square miles, 12,582 in Nevada, 3,675 in California, and 346 in Oregon. The central part of the Sub-Basin is composed primarily of unproductive, barren, black rock desert. There are low mountain ranges with elevations of 6,000 feet and scattered peaks at 9,000 feet above sea level rising from generally flat desert of 4,000 feet elevation.

Although much of the Nevada portion of the Sub-Basin is barren desert, much of the California portion is covered with pine and fir timber at higher elevations and junipers and sage brush at lower elevations. The California portion also includes several lakes which formerly may have been part of the Lake Lahontan System, which at one time apparently covered much of the State of Nevada and some adjacent parts of California and Oregon. Upper, Alkali, Eagle, and Honey Lakes are the largest in this group of lakes formed by the disruption of valleys formerly connected to the Lahontan System.

In the Nevada portion of the Sub-Basin, precipitation increases from an annual average of 4.7 inches in the southwest to 5.9 inches in the northeast. Over 26 percent of the total precipitation occurs during December, January, and February as snow. Temperatures range from a minimum of -38° F. to a maximum of 108° F., with an average annual low of 26° F. and high of 70° F.

In the California portion of the Sub-Basin, the annual precipitation varies in general with the elevation. Doyle, at 4,000 feet, has an average precipitation of 9.16 inches, the lowest of any of the five precipitation stations, while Fort Bidwell at 4,235 feet elevation has an average of 17.69 inches. Susanville, at 4,271 feet elevation, has an average of 20.05 inches, however, the highest rainfall of any of the stations. Susanville also has the highest annual snowfall of 71.9 inches as compared to 52.6 inches at Cedarville and 48 inches at Fort Bidwell. Average annual temperatures in the California portion of the Sub-Basin are apparently more uniform than in the Nevada portion with a low of 35.4 degrees and high of 62.8 degrees at Susanville. The lowest recorded temperature is -19° F. at Fort Bidwell and highest 108° F. at Cedarville. The climatic data of the Oregon portion of the Sub-Basin is similar to the California portion.

The population of the Sub-Basin was approximately 19,600 in 1950, 16,700 in the California portion, 2,800 in the Nevada portion, and less than 100 in the Oregon portion. The population densities in persons per square mile are 4.55 for the California portion, 0.22 for the Nevada portion, 0.19 for the Oregon portion, and 1.18 for the Sub-Basin as a whole. The greatest center of population is the Susan River Valley of Lassen County, California. Lassen County contributes over 11,700 of the total population in the Sub-Basin.

In the Nevada portion of the Sub-Basin there is little industrial activity with the exception of scattered mines and a plaster board factory near Gerlach. Agricultural activities of this portion are confined to minor sustenance operations in the eastern portion.

In the California and Oregon portions of the Sub-Basin agriculture, including livestock grazing and dairying, and lumbering are the principal activities.

Summary of Water Pollution Data

There are only four sources of domestic sewage pollution of significance in the Sub-Basin. Three of these communities, with a connected population of 10,500 are located in the California portion of the Sub-Basin and one community with a connected population of 300 is located in the Nevada portion of the Sub-Basin.

There are only four known sources of industrial pollution in the Sub-Basin, three with organic wastes located in California portion, and one with inorganic wastes located in the Nevada portion. There is no information available as to the population equivalent of the organic wastes or as to the nature of the inorganic wastes produced.

Three of the communities with domestic waste disposal problems have provided primary treatment plants and one has provided secondary treatment for their wastes. The population served by primary treatment plants is 10,500 and that served by a secondary treatment plant is 300. Two of the industries with organic wastes, one food products plant and one wood products plant, as well as the one mining industry with inorganic wastes, now have industrial waste treatment facilities. There is no information available as to the waste treatment facilities at the other known wood products plant.

There are no known pollution problems in the Oregon portion of the Sub-Basin, and the only community with a domestic sewage collection system and the only industry with a waste disposal problem in the Nevada portion of the Sub-Basin have been provided with satisfactory treatment facilities. Only one of the three communities in the California portion of the Sub-Basin with sewage collection systems has provided treatment facilities which, under the former permit system of the State Department of Public Health, were considered adequate as to design capacity and degree of treatment provided. However, under present California legislation, the Regional Water Pollution Control Board has primary responsibility for determination of adequacy of treatment works to meet its requirements for receiving waters or disposal areas. One of the two communities with unsatisfactory treatment facilities has started construction of additions to the existing plant and the other has started construction of a new plant to replace existing facilities.

Treatment works at two of the industries in the California portion of the Sub-Basin have been reported by the State Department of Public Health, on the basis of their past contacts, to be satisfactory as to capacity and degree of treatment. The treatment requirements at the third known industry have not been determined.

Cost of the treatment facilities for the two communities now under construction in the Sub-Basin is estimated at $193,000. The projects have been financed and when construction is completed all known sources of pollution in the Sub-Basin will have been provided with satisfactory treatment. The following communities, with population less than 600, are not now significant sources of pollution but will become significant if and when public sewer systems are provided: Gerlach, Nev.; McDermitt, Nev.; Fort Bidwell, Calif.; Cedarville, Calif.; and Litchfield, Calif.

The only two rivers of importance in the Nevada section of the Sub-Basin are the Quinn and the Kings. The only water uses are stock watering and irrigation. Little, if any, pollution from domestic or industrial sources reaches these rivers and the water is considered satisfactory for the indicated uses.

The Susan River, Long Creek, and other tributaries of Honey Lake are the most important streams in the California portion of the Sub-Basin. The principal water uses for these streams are agricultural including livestock watering and irrigation, and recreational including game fishing, bathing, wildlife and other recreational uses. Existing treatment facilities and those now under construction should eliminate the major sources of pollution on these streams and assure water of satisfactory quality for indicated uses under present conditions. There are no known sources of pollution in the other streams in the California and Oregon portions of the Sub-Basin with the possible exception of log ponds used in connection with lumbering operations.

All of the streams in the Sub-Basin discharge to lakes or dry sinks and no surface water is exported from the Sub-Basin.

Table A1. Sources of pollution, municipal

Municipalities*	Sources of pollution (in number of municipalities)	Population served by sewerage system	Amount of pollution discharged to watercourse (in terms of equivalent number of people)**
Having data on pollution load discharge to watercourse	4	10,800	6,800
Having population data available (Data on pollution load to watercourse incomplete or not available)	---	---	Not applicable
Total	4	10,800	---

*Includes incorporated or unincorporated municipalities, other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers; sanitary sewage wastes discharged by industry directly to watercourse.

One of the four communities serving 300 of the 10,800 population discharges additional wastes with a population equivalent of 30 to land.

**Includes industrial wastes discharged into municipal sewage systems.

Table B_1. Sources of pollution, industrial*

Industries	Sources of pollution (in number of plants)	Amount of pollution discharged to watercourse (in terms of equivalent number of people)
Producing organic wastes	--	--
Producing organic wastes	3	Undetermined
Producing inorganic wastes	1	Not applicable
Producing wastes of undetermined type	--	Undetermined
Total	4	--

*Industries having separate outlets and discharging wastes directly to watercourse or land.

Table C_1.

Existing treatment facilities, municipal

Degree of treatment provided	Number		Population served
	Municipalities*	Plants	
Primary	3	3	10,500
Secondary	1	1	300
No treatment	--	--	--

*Includes incorporated or unincorporated municipalities, other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers; sanitary sewage wastes discharged by industry directly to watercourse.

Table D_1. Existing treatment facilities, industrial*

Type industry	Number of plants	Number of industrial plants having:		
		Treatment facilities	No treatment facilities	Undetermined facilities
Manufacturing industries:				
Food and kindred products.....	1	1	--	--
Lumber and wood products (except furniture).....	2	1	--	1
Nonmanufacturing industries:				
Other mining industries	1	1	--	--

*Industries having separate outlets and discharging wastes directly to watercourse or land.

Table E_1. Adequacy of existing treatment facilities

Existing treatment facilities	Number	Adequacy with relation to:					
		Capacity			Operation		
		Satisfactory	Unsatisfactory	Undetermined	Satisfactory	Unsatisfactory	Undetermined
Municipal	4	2	2	--	2	2	--
Industrial	3	3	--	--	3	--	--

Table F1. Progress in Pollution Abatement

Year	Municipal		Industrial	
	Plants Completed	Design Population	Plants Completed	Amount of waste treated (in terms of equivalent number of people)
1946	--	--	--	--
1947	--	--	--	--
1948	--	--	--	--
1949	--	--	--	--
1950	--	--	--	--

All significant sources of municipal pollution and 3 of the 4 industries having separate outlets have been provided with treatment facilities prior to 1946.

Table G1. Requirements for municipal and industrial waste treatment plants*

Requirements	Municipal		Industrial
	Number	Population served by facilities	Number
New plant	--	--	--
Enlargement or additions to existing plant	1	[illegible]	--
Replace existing plant	1	[illegible]	--
No project required	2	[illegible]	[illegible]
Undetermined	--	--	[illegible]

*The needs set forth in this table are based on presently available information. However, future studies and evaluation may result in some changes in these needs.

Table H1. Status of treatment works projects to abate pollution, July 1, 1950

Status of project	Number	
	Municipal	Industrial
No formal action	--	--
Abatement ordered	--	--
Plans under preparation	--	--
Final plans approved	--	--
Construction financing	--	--
Under construction	[illegible]	--
Status undetermined	--	[illegible]

Table I1. Project list* - municipalities and industries requiring improvements for abatement of pollution, July 1, 1950

Name**	Population served	Project requirements	Remarks
California:			
California City A	[illegible]	Replace existing plant	--
California City B	[illegible]	Replace existing plant	--

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

**The California municipalities listed as requiring projects have been added because the recently established California State and Regional Water Pollution Control Boards have not had time to evaluate formerly determined waste treatment requirements.

HUMBOLDT RIVER SUB-BASIN

Description and Economic Development

Generally speaking, the Humboldt River Sub-Basin lies in north central Nevada. With the exception of the eastern and western tips and irregular southern extremities, the Sub-Basin lies between 40° and 42° north latitude and 115° to 118° west longitude. The Sub-Basin is very irregular in shape and has its extreme axes in north-south and northeast-southwest directions with boundaries being approximately 218 and 234 miles apart, respectively. All of the Sub-Basin lies within the State of Nevada.

The Sub-Basin drains an area of approximately 16,080 square miles, representing about 14.5 percent of the total area of the State. It is a high semi-arid plateau with numerous mountain ranges transversing it in a general north-south direction. The ranges vary up to 250 miles in length and are at elevations of 6,000 to 11,000 feet separated by broad flat valleys at elevations of 4,000 to 6,000 feet above sea level. Precipitation in this area increases from west to east. In the northwestern portion the average precipitation rarely exceeds five inches while the mountain ranges and higher valleys to the east have annual averages of from ten to twenty inches. Wide extremes in temperature are common. Average January temperatures are 24° F. to 29° F., and average July temperatures are 67° F. to 73° F., with minimums of -42° F. and maximums of 112° F.

The Humboldt River is the main water course in the area. It heads in the northeastern portion of the Sub-Basin and is fed by numerous streams near its south end. Starr, Rock, South Fork of the Humboldt and Marys creeks from the north, and Starr Creek, Lamoille Creek, and South Fork of the Humboldt from the south, all in the vicinity of Elko, contribute flow to the river. Below Palisade, the point of greatest elevation along the River, Rock Creek and Pine Creek below Palisade, furnish a small but essentially early season flow. The Reese River, which joins the Humboldt near Battle Mountain, has a large drainage area in the Toiyabe Mountains and contributes flow very irregularly. The river enters the Humboldt sink area near Lovelock and disappears in a large alkaline area. The Little Humboldt River with its tributaries North Fork, Martin Creek, and Cottonwood Creek, at one time joined the Humboldt near Winnemucca. This river is no longer a surface tributary due to the formation of a sand barrier across the lower end of the Little Humboldt Valley.

Agriculture, stock raising and mining activities are the primary sources of income in this Sub-Basin. Limited water supply and soil conditions make stock raising more important than crop farming in the larger portion of the area. The Sub-Basin had a population of approximately 14,700 in 1940 and 16,600 in 1950. The majority of the population is concentrated in municipalities along the Humboldt River with the remainder being scattered throughout the area in small farming or mining communities.

The principal water uses in the Sub-Basin are for irrigation, livestock and game fish. No domestic supplies are known to be taken from the Humboldt River.

Summary of Water Pollution Data

No pollution is known to exist in this area other than along the Humboldt River. Effluent from four municipal waste treatment plants and sewage from three collection systems are discharged into the drainage area. Elko, with a population of approximately 5,400, should be provided with secondary treatment on the basis of population served, anticipated growth, and effluent discharge to the Humboldt River. Wells, Austin, and Lovelock are at present applying raw sewage to land along the banks of the Humboldt River and in the Reese River watershed and should at least be provided with some type of primary treatment. Carlin and Winnemucca have primary treatment with effluent discharging into the Humboldt River. Battle Mountain has primary treatment followed by oxidation ponds and the effluent is utilized for irrigation with excess finally reaching the Humboldt River. Requirements, if any, for the above three municipalities are undetermined until such time as stream standards are established.

The cost of providing primary treatment for Austin, Lovelock and Wells which now have no sewage treatment facilities, and secondary treatment for Elko which is growing so rapidly that the Humboldt River soon may not provide adequate dilution for the primary effluent, is estimated roughly at $ 293,000. If, on the basis of additional information, it becomes necessary to provide secondary treatment for Battle Mountain, Carlin and Winnemucca, the additional cost is roughly estimated at $ 218,400 to a total of $ 511,000 for the Sub-Basin. On the basis of present information there are no industrial waste disposal problems in the Sub-Basin which require additional construction.

The water in all of the streams in the Sub-Basin is of satisfactory quality for present uses, except in the lower reaches of the main stem of Humboldt River where the high salt content renders the water practically useless for all purposes. The increase in salt content is due largely to minerals leached from alkali soils and drained to the streams with return irrigation water. The return flow around Lovelock increases the salt content to such an extent that the river has little use below this point. The Humboldt River drains to Humboldt Lake, an alkali lake approximately 12 miles below Lovelock, and no water is ordinarily exported from the Sub-Basin.

Table A_2. Sources of pollution, municipal

Municipalities*	Sources of pollution (in number of municipalities)	Population served by sewerage system	Amount of pollution discharged to watercourse (in terms of equivalent number of people)**
Having data on pollution load discharge to watercourse	7	13,035	7,600
Having population data available (Data on pollution load to watercourse incomplete or not available)	--	--	Not applicable
Total	7	13,035	--

*Includes incorporated or unincorporated municipalities, other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers; sanitary sewage wastes discharged by industry directly to watercourse.

Three of the seven communities serving 2,958 out of the 13,035 persons discharge wastes having an additional population equivalent of 2,340 to land.

**Includes industrial wastes discharged into municipal sewage systems.

Table B_2. Sources of pollution, industrial*

Industries	Sources of pollution (in number of plants)	Amount of pollution discharged to watercourse (in terms of equivalent number of people)
Producing organic wastes	0	--
Producing organic wastes	0	Undetermined
Producing inorganic wastes	4	Not applicable
Producing wastes of undetermined type	0	Undetermined
Total	4	--

*Industries having separate outlets and discharging wastes directly to watercourse or land.

Table C_2.

Existing treatment facilities, municipal

Degree of treatment provided	Number		Population served
	Municipalities*	Plants	
Primary	3	3	9,402
Secondary	1	1	735
No treatment	3	0	2,958

*Includes incorporated or unincorporated municipalities, other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers; sanitary sewage wastes discharged by industry directly to watercourse.

Table D_2. Existing treatment facilities, industrial*

Type industry	Number of plants	Number of industrial plants having:		
		Treatment facilities	No treatment facilities	Undetermined facilities
Nonmanufacturing industries: Other mining industries..	4	4	--	--

*Industries having separate outlets and discharging wastes directly to watercourse or land.

Table E_2. Adequacy of existing treatment facilities

Existing treatment facilities	Number	Adequacy with relation to:					
		Capacity			Operation		
		Satisfactory	Unsatisfactory	Undetermined	Satisfactory	Unsatisfactory	Undetermined
Municipal	4	0	1	3	4	0	0
Industrial	4	4	--	--	4	--	--

Table F_2. Progress in pollution abatement

Year	Municipal		Industrial	
	Plants completed	Design population	Plants completed	Amount of waste treated (in terms of equivalent number of people)
1946	--	--	--	--
1947	--	--	--	--
1948	Battle Mt.	800	--	--
1949	--	--	--	--
1950	--	--	--	--

Table G_2. Requirements for municipal and industrial waste treatment plants*

Requirements	Municipal		Industrial
	Number	Population served by facilities	Number
New plant	3	2,958	--
Enlargement or additions to existing plant	--	--	--
Replace existing plant	1	5,389	--
No project required	--	--	--
Undetermined	3	4,748	--

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

Table H_2. Status of treatment works project to abate pollution, July 1, 1950

Status of project	Number	
	Municipal	Industrial
No formal action	6	--
Abatement ordered	--	--
Plans under preparation	--	--
Final plans approved	1	--
Construction awaiting financing	--	--
Under construction	--	--
Status undetermined	--	--

Table I_2. Project list* - municipalities and industries requiring improvements for abatement of pollution, July 1, 1950

Name	Population served	Project requirements	Remarks
Nevada:			
Wells	939	New plant	--
Elko	5,389	Replace existing plant	--
Carlin	1,199	--	Undetermined
Battle Mt.	735	--	Undetermined
Winnemucca	2,816	--	Undetermined
Lovelock	1,613	New plant	--
Austin	405	New plant	--

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

GREAT SALT LAKE SUB-BASIN

Description and Economic Development

Great Salt Lake Sub-Basin embraces the northern portion of the Bonneville basin. It extends from the Snake River drainage area on the north to an indistinct bar laid down by Lake Bonneville on the south and from the Green River drainage area on the east to the Central Nevada area on the west. It covers 34,849 square miles, 23,782 of which are in Utah, 6,048 in Nevada, 3,548 in Idaho, and 1,471 in Wyoming.

Latest census figures indicate the population of this Sub-Basin to be about 591,300. Over 85 percent of the people inhabit the Wasatch Front, the northeastern portion of the Sub-Basin and the area of major economic activity in Utah.

The Wasatch Front is the western slope of the Wasatch Mountains and extends westward to the eastern shore of Great Salt Lake. The western portion of the Sub-Basin is composed of Great Salt Lake, extensive salt deserts, and barren waste land with occasional precipituous mountains rising out of the flat waste land.

The most developed areas of the Sub-Basin lie between 4,300 feet and 4,800 feet above sea level. The eastern ranges peak at 12,000 feet and the great waste lands to the west are at about 4,200 feet above sea level.

There is no drainage from this Sub-Basin. The primary streams are the Bear, Weber, Ogden, and Jordan Rivers which terminate in Great Salt Lake, plus numerous smaller streams which drain to Great Salt Lake directly or through Utah Lake and the Jordan River. Although the general drainage area extends into several States, the only streams which cross State lines are the Bear River and some of its tributaries, and Chalk Creek a branch of the Weber River. All of the other flowing streams originate and terminate within Utah.

Precipitation varies from six inches of rain and snow over the extensive western wastelands to 40 inches which falls primarily as snow on the southern peaks of the Wasatch Range. The average precipitation in the cultivated areas is 16 inches per year. The average January temperatures range from 28° F. in the vicinity of Great Salt Lake to 16° F. in the eastern mountains. Average July temperatures range from 80° F. on the desert to 64° F. in the mountains. The growing season varies from 140 to 160 days in the farming areas.

Although the original economy of agriculture still dominates the Sub-Basin, the metals industry and manufacturing are becoming quite prominent. Agricultural activity has about reached the maximum expansion allowed by presently available water supplies. Although more efficient use of existing irrigation water resources and more efficient farming methods (census figures show a marked increase from 1920 to 1945 in the number of farms under 10 acres) may increase agricultural production, it is not probable that it will keep pace with the industrialization of the Sub-Basin. The Sub-Basin now has the largest steel mill west of the Mississippi River, the largest open cut copper mine in the world, extensive mining and smelting of copper, lead, zinc, gold, and silver, extensive oil refining activities and ever increasing manufacturing, business, and service activities. Salt Lake City and Ogden are on primary cross country arteries. This coupled with the history of the area and its general geographical advantages make the Sub-Basin attractive to millions of tourists each year. Salt Lake City alone boasts over 6,000 units for transient accommodation.

Here, as in most sections of the arid west, the primary use of water is for irrigated agriculture. High mountain streams and artesian wells furnish most domestic water, and sources of industrial water supplies vary from private wells to public municipal supplies. Fishing and hunting are popular recreational activities which are supported by the water resources. Thirty-seven hydro-electric plants in the Sub-Basin have a total installed capacity of over 144,000 kilowatts.

Summary of Water Pollution Data

There are 50 sewered communities in the Sub-Basin which serve over 327,700 persons. Forty-five of these communities serving 322,350 people discharge wastes with a population equivalent of 426,500 to surface watercourses and the remaining five communities serving 5,450 people discharge wastes with a population equivalent of 3,630 to land. Eleven of these communities serving over 19,100 people have primary treatment, five have secondary treatment for 5,450 persons and 34 communities with a total population served of 303,180 are without treatment facilities. Of the 16 communities having treatment, the facilities at eight are considered adequate and eight inadequate with regard to capacity and degree of treatment. The operation of existing facilities is

satisfactory at nine communities and unsatisfactory at seven.

Pollution abatement activities have probably progressed slowly in this Sub-Basin, because of lack of adequate statutes and an indifference on the part of the people. Only three communities have constructed treatment facilities in the postwar years. One of these designed for 4,000 persons was built in 1949 and two designed for a total of 10,100 persons in 1950. Requirements listed by State Health officials indicate the need for 33 new plants to serve 302,300 people, six enlargements or additions to existing facilities serving 7,400 persons and the replacement of two plants serving 2,300 persons. There are only nine plants serving 15,600 persons which are considered satisfactory. One of the communities where conditions are considered satisfactory is without any treatment.

The cost of needed municipal sewage treatment plant construction is estimated at approximately $5,280,000. This estimate does not include sewer or interceptor construction nor does it consider future growth and subsequent needs.

No formal action has been taken to provide needed treatment facilities at 33 communities, five communities have plans under preparation and the status of three others is undetermined.

Intensive field survey activities of the Utah State Department of Health have clarified the industrial picture of this Sub-Basin. Ninety-nine industries which have separate waste outfalls are recognized. Seventy-five of these produce organic wastes which have been estimated to have a population equivalent of over 1,050,000. Fifty-four of the 99 industries provide some form of waste treatment. Facilities at 17 of those providing treatment are considered satisfactory as to capacity and degree of treatment, while seven are considered unsatisfactory and the adequacies of 30 more are undetermined.

Operation of existing treatment facilities is considered satisfactory at 21 industries and unsatisfactory at three, while the conditions of operation at the remaining 30 are undetermined.

Industries of the Sub-Basin have been somewhat more active in the construction of waste treatment plants than have the communities. In the postwar years six industrial establishments have installed treatment facilities. Three of these, designed for wastes with a total population equivalent of 15,000, were constructed in 1948, two more were constructed in 1949 for wastes with a population equivalent of 4,500, and one was built in 1950 for wastes with a population equivalent of 49,000. Two of the six, one built in 1948 and the other in 1949 were oil separators and were not constructed for the reduction of organic pollution. Authorities believe that 37 of the 99 industries should construct new treatment plants and that seven should add to or enlarge their present facilities, while 17 industries require no project and the needs of 37 additional industries require further study and, therefore, are not now known. Two individual industrial sources are discharging to a single outfall and could be adequately served by one treatment plant. At the present, action is being taken in only one instance, where treatment facilities are under construction.

The extensive network of irrigation canals complicates the stream pollution picture. Much waste material is discharged to waters flowing away from natural stream beds and reach surface streams only as return flow if at all. The use of sewage and sewage polluted waters for irrigation and stockwatering is common in the Sub-Basin. No specific studies

Table A3. Sources of pollution, municipal

Municipalities*	Sources of pollution (in number of municipalities)	Population served by sewerage system	Amount of pollution discharged to watercourse (in terms of equivalent number of people)**
Having data on pollution load discharged to watercourse	50	327,725	428,520
Having population data available (Data on pollution load to watercourse incomplete or not available)	--	--	Not applicable.
Total	50	327,725	--

*Includes incorporated or unincorporated municipalities, other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers; sanitary sewage wastes discharged by industry directly to watercourse.

Five of the 50 sources listed serving 5,450 of the 327,725 persons discharge an additional population equivalent of 3,630 to land. These are: Baccus, Wendover, Tooele Ordinance Depot, Western Chemical, and Dugway Proving Ground.

**Includes industrial wastes discharged into municipal sewage systems.

on the effects of these uses have been made and no water quality standards for these uses have been adopted in Utah. The Utah State Department of Health has established the policy of considering all such uses of polluted water unsatisfactory because of the potential hazards of existing practices.

The most evident pollution problems arise not from use of water containing sewage but rather from the direct use of the sewage itself. It is common practice to convey wastes to receiving bodies through open sewage canals. The diversion of the sewage prior to any dilution is prevalent in the Sub-Basin and is the source of much concern to State officials.

Table B_3. Sources of pollution, industrial*

Industries	Sources of pollution (in number of plants)	Amount of pollution discharged to watercourse (in terms of equivalent number of people)
Producing organic wastes	75	1,050,00
Producing organic wastes	t	Undetermined
Producing inorganic wastes	15	Not applicable
Producing wastes of undetermined type	3	Undetermined
Total	99	--

*Industries having separate outlets and discharging wastes directly to watercourse or land.

One other problem in the Sub-Basin has been in the watersheds which provide the municipal water supply for Salt Lake City. Salt Lake City is served by diversion from streams in the canyons radiating from the city. These mountainous areas support highly developed recreational activities and the ensuing danger to the water supply has been widely discussed by State and local officials.

The three largest cities, Salt Lake City, Ogden, and Provo, discharge their sewage without treatment. Preliminary studies are under way in Ogden but no action has been taken by the other cities. The problem of disposal to Great Salt Lake is unique because of the large salt content of the receiving water and requires special studies.

Table C_3.

Existing treatment facilities, municipal

Degree of treatment provided	Number		Population served
	Municipalities*	Plants	
Primary	11	11	19,125
Secondary	5**	5	5,450
No treatment	34	--	303,150

*Includes incorporated or unincorporated municipalities, other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers; sanitary sewage wastes discharged by industry directly to watercourse.

**Includes 4 communities having satisfactory land disposal after sedimentation

Table D_3. Existing treatment facilities, industrial*

Type industry	Number of plants	Number of industrial plants having:		
		Treatment facilities	No treatment facilities	Undetermined facilities
Manufacturing industries:				
Food and kindred products	75	38	34	3
Textile mill products	2	--	2	--
Chemical and allied products	2	2	--	--
Products of petroleum or coal	5	4	1	--
Primary metal industries	6	4	2	--
Fabricated metal products (except ordnance, machinery, and transportation equipment)	1	--	1	--
Miscellaneous	4	3	1	--
Nonmanufacturing industries:				
Oil production industry	--	--	--	--
Other mining industries	4	3	1	--

*Industries having separate outlets and discharging wastes directly to watercourse or land.

Table D_4. Adequacy of existing treatment facilities

Existing treatment facilities	Number	Adequacy with relation to:					
		Capacity			Operation		
		Satisfactory	Unsatisfactory	Undetermined	Satisfactory	Unsatisfactory	Undetermined
Municipal	16	16		--			--
Industrial	44	8		36	11	3	30

Table D_5. Trend of construction (dollars)

Year	Municipal		Industrial	
	Plants completed	Cost of plants completed	Plants completed	Amount of waste treated (in terms of equivalent number of people)
1941	--	--	--	--
1942	--	--	--	--
1943	--	--	2	15,000
1944	1	4,000	2	4,500
1950	2	5,000	1	40,000

Table G_3. Requirements for municipal and industrial waste treatment plants***

Requirements	Municipal		Industrial
	Number	Population served by facilities	Number
New plant	33**	302,250	37
Enlargement or additions to existing plant	[illegible]	7,425	[illegible]
Replace existing plant	2	2,30[illegible]	[illegible]
No project required	9*	15,75[illegible]	1[illegible]
Undetermined	[illegible]	[illegible]	3**

*Includes one town now without treatment.
**Two plants discharge to a single outfall.
***The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

Table H_3. Status of treatment works project to abate pollution, July 1, 1950

Status of project	Number	
	Municipal	Industrial
No formal action	33	75*
Abatement ordered	--	--
Plans under preparation	9	--
Final plans approved	--	--
Construction awaiting financing	--	--
Under construction	--	--
Status undetermined	3	5

*Includes one project which will serve two industries.

Table I_3. Project list**** - municipalities and industries requiring improvements for abatement of pollution, July 1, 1950

Name**	Population served***	Project requirements	Remarks
[illegible]	[illegible]	New plant	--
[illegible]	[illegible]	Enlargement or addition	Existing septic tank
[illegible]	[illegible]	New plant*	Existing septic tank and underground disposal
[illegible]	[illegible]	New plant	--
[illegible]	[illegible]	Enlargement or addition	--
[illegible]	[illegible]	New plant*	Existing septic tank
[illegible]	[illegible]	New plant	--
[illegible]	[illegible]	New plant	--
[illegible]	[illegible]	New plant*	Existing septic tank
[illegible]	[illegible]	New plant*	Existing septic tank
[illegible]	[illegible]	Enlargement or addition	Existing septic tank
[illegible]	[illegible]	New plant	--
[illegible]	[illegible]	New plant	Good sewer system and treatment
[illegible]	[illegible]	Enlargement or addition	--
[illegible]	[illegible]	Enlargement or addition	--
[illegible]	[illegible]	New plant*	Existing septic tank
[illegible]	[illegible]	New plant	--
[illegible]	[illegible]	New plant	--
[illegible]	[illegible]	New plant	--

See footnotes at end of table.

Table I$_3$. Project list**** - municipalities and industries requiring improvements for abatement of pollution, July 1, 1950--Continued

Name**	Population served***	Project requirements	Remarks
Magna	1,200	Enlargement or addition	--
Midvale	3,300	New plant*	Existing septic tank
Montpelier**	1,000	New plant	--
Murray	1,800	New plant*	Existing septic tank
Ogden	40,000	New plant	--
Orem	2,600	New plant*	Existing septic tank
Park City	3,000	New plant	--
Paris**	300	Replace existing plant	--
Payson	2,000	Replace existing plant	Existing Imhoff tank overloaded by 200%
Provo	24,000	New plant	--
Saltair Beach	1,700	New plant	--
Salt Lake City	158,000	New plant	--
Sandy	150	Enlargement or addition	--
Soda Springs**	600	New plant	--
South Ogden	3,000	New plant*	Existing septic tank
Spanish Fork	4,300	New plant	--
Springville	2,000	New plant	--
Sunset Beach	4,000	New plant*	Existing septic tank and ground disposal deemed unsafe
Taylorsville	350	New plant*	Existing septic tank
Tooele	3,500	New plant*	Existing septic tank
Tremonton	1,600	New plant*	Existing septic tank
Wellsville	500	New plant	--
Allen Meat Co.	250	New plant	Near Tremonton
Amalgamated Sugar Co.	208,000	Undetermined	Near Lewiston
Arden Dairy	400	New plant	American Fork
Arthur Mill	Inorganic	Undetermined	Near Arthur
Baron Woolen Mills	530	New plant	Brigham City
Bountiful Dairy	50	New plant	Bountiful
Box Elder Packing Corp.	14,700	Undetermined	Brigham City
Brooklawn Creamery	150	New plant	Near Park City
Cache Valley Dairy Assoc.	2,400	New plant	Near Lewiston
California Packing Co.	35,200	Undetermined	Near Lewiston
California Packing Co.	42,500	Undetermined	Ogden
California Packing Co.	1,050	New plant	Near Wellsville
California Packing Co.	11,000	Undetermined	Spanish Fork
California Packing Co.	1,000	Undetermined	Near Devils Slide
Cascade Fish Co.	Unknown	Undetermined	Charleston
Cudahy Packing Co.	15,000	Undetermined	Salt Lake City
Custom Slaughtering	300	New plant	Riverton
Dixon Slaughterhouse	180	New plant	Payson
Joe Dusterman & Son	80	New plant	So. Salt Lake
Joe Dusterman & Son	1,900	New plant	So. Salt Lake
Draper Egg Products	1,490	Undetermined	Draper
Ellington Cannery	6,000	Undetermined	Springville
Garfield Smelter	--	Undetermined	Garfield
Geneva Steel	49,000	Undetermined	Geneva
Geneva Steel	20,400	Undetermined	Ironton Plant
Kaiser-Frazer Parts			Ironton Plant
Granite Meat & Livestock	1,600	New plant	Murray
Granite School District Cannery	900	New plant	So. Salt Lake
Harper Meat Co.	140	New plant	Brigham City
Hogan Dairy	30	New plant	West Jordan
Hunt Foods	14,000	Undetermined	Murray

See footnotes at end of table.

Table I_3. Project list**** - municipalities and industries requiring improvements for abatement of pollution, July 1, 1950--Continued

Name**	Population served***	Project requirements	Remarks
International Smelter.....	--	Undetermined	Tooele
Rendell James.....	130	New plant	Spanish Fork
Jex Slaughterhouse.....	220	New plant	Spanish Fork
Jordan Meat & Livestock Co.	580	New plant	So. Salt Lake
Juab Co. Mill & Elevator.....	160	New plant	Nephi
Kaysville Canning Co.	6,000	Undetermined	Syracuse
Kaysville Canning Co.	13,000	Undetermined	Kaysville
J. Kuhni & Son.....	600	New plant	Ironton
Lehi Roller Mills.....	220	New plant	Lehi
Archie McFarland & Sons.....	7,700	New plant	So. Salt Lake
Magna Mill.....	--	Undetermined	Magna
E. A. Miller Packing Co.	800	New Plant	Near Wellsville
L. L. Miller Packing Co.	340	Undetermined	Near Wellsville
Morning Milk Co.....	830	Undetermined	Near Wellsville
Moss Dairy.....	20	Undetermined	Woods Cross
Murray Laundry.....	1,400	New plant	Murray
Ogden Dressed Meat Co.	4,000	New plant	Ogden
Ogden Union Stockyards.....	560	New plant	Ogden
Pleasant Grove Canning Co.	31,500	Undetermined	Orem
Pleasant Grove Canning Co.	8,000	New plant	Pleasant Grove
Pacific States CI Pipe Co.	--	Undetermined	Ironton
Park City Mill.....	--	Undetermined	Park City
Perry Canning Co.	4,000	Undetermined	Near Perry
Republic Creosote Plant.....	--	New plant	Ironton
Rosehill Dairy.....	40	New plant	So. Salt Lake
Sego Milk Co.	2,260	New plant	Near Lewiston
Sego Milk Co.	80	New plant	Near Wellsville
Smith Canning Co.	8,000	Undetermined	Clearfield
Smoot Dairy.....	20	Undetermined	Centerville
Solar Corp.....	--	Undetermined	Ogden
Standard Oil of Calif.....	--	Enlargement or addition	Salt Lake City
Neil Thomas Slaughterhouse....	250	New plant	Spanish Fork
Union Pacific.....	--	Undetermined	Salt Lake City
U & I Sugar Co.	200,000	Undetermined	Near Garland
U & I Sugar Co.	93,000	Undetermined	West Jordan
Utah By-Products.....	130	Undetermined	Near Garland
Utah By-Products.....	--	Enlargement or addition	Ogden
Utah County Packing Co.	500	Undetermined	Ironton
Utah Hide & Tallow Co.	--	New plant	Spanish Fork
Utah Oil.....	--	Enlargement or addition	Salt Lake City
Utah Wool Pulling.....	--	New plant	Salt Lake City
Wasatch Oil Refinery.....	--	Enlargement or additon	Woods Cross
Western States Oil.....	--	Undetermined	Salt Lake City
Woods Cross Canning Co.	7,600	New plant	Woods Cross

*The Utah State Department of Health has listed these 14 communities with obsolete and inadequate septic tanks as having no treatment and therefore has shown them as requiring "New plants" rather than "Additions" or "Replacement of existing plants".

**All towns are in Utah except those indicated by ** which are in Idaho.

***In case of industry figures represent population equivalents.

****The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

LAKE TAHOE--TRUCKEE-CARSON RIVERS SUB-BASIN

Description and Economic Development

The Lake Tahoe and Truckee-Carson Rivers Sub-Basin lies along the Nevada-California State line adjoining the slopes of the Sierra Nevada Mountains. The western portion of the Sub-Basin comprises the drainage areas of the Truckee and Carson Rivers which flow from southwest to northeast. The eastern portion of the Sub-Basin approaches the desert area of Central Nevada and has no well-defined drainage.

The Sub-Basin embraces an area of approximately 13,200 square miles in Nevada, representing about 12 percent of the total area of the State and approximately 1,210 square miles in California representing less than one percent of the total area of the State. The Nevada portion of the Sub-Basin, like the rest of the State, is a semi-arid plateau ranging in elevation from 4,000 to 5,500 feet. Scattered mountain ranges reaching elevations above 8,000 feet are common particularly in the eastern portion. The California portion of the Sub-Basin lies along the eastern slope of the Sierra Nevada Mountains and is mostly mountainous and heavily timbered.

Precipitation in the Sub-Basin decreases from west to east due to the influence of the Sierra Nevada Mountains. The average annual precipitation decreases from 29.4 inches at Lake Tahoe to from 25-27 inches in the easterly higher regions, 8-9 inches in the Reno, Carson area, to approximately five inches in the lower easterly and northerly plateaus. Wide variation in temperatures are common with January figures averaging from 28° to 32° F. and July figures averaging from 60° to 76° F. The maximum temperature is around 110° F. and the minimum around -30° F.

The 1950 population of the Sub-Basin was approximately 65,800, 63,300 in the Nevada portion and 2,500 in the California portion. The population densities in persons per square mile in 1950 were 4.8 for the Nevada portion and 2.1 for the California portion. The population increased from 48,100 in 1940 to 65,800 in 1950, an increase of 38 percent in ten years. The population is centered around the Reno-Sparks area with a combined population of over 40,000 and the Lake Tahoe area with a peak population of 15,000 during the summer recreation season.

Agricultural activities, including stock raising, field and truck crops, and dairying comprise the principal industries in the Nevada portion of the Sub-Basin. The annual rainfall is insufficient to permit crop production by dry farming methods except close to the Sierra Nevada Mountains, but by use of extensive irrigation the Sub-Basin has been converted into the most productive area in the State. The urban influence of the Reno-Sparks area strongly affects the activities of the southern Washoe County portion of the Sub-Basin. The Reno and Lake Tahoe areas also attract many tourists.

Lumbering and recreation are the principal industries in the California portion of the Sub-Basin. Lake Tahoe at elevation 6,225 is a popular summer resort area for bathing and boating, and the surrounding mountains provide hunting and winter sports. The Lake and its tributary streams also provide excellent fishing.

The Truckee River, fed mainly by Lake Tahoe, and the Carson River are the principal streams in the Sub-Basin. Lake Tahoe is approximately 20 miles long by 10 miles wide and covers an area of 193 square miles. Approximately two-thirds of the lake is in California and one-third is in Nevada. Much of the shore line has been developed into summer home and resort areas. The headwaters of both the Truckee and Carson Rivers are in the mountainous California portion of the Sub-Basin. The principal water uses occur in the semi-arid plateaus at the base of the mountains, mostly in the Nevada portion of the Sub-Basin. The two main rivers as well as all of the smaller streams eventually enter alkali lakes or sinks and no water is exported from the Sub-Basin.

Summary of Water Pollution Data

There are 16 known sources of municipal pollution in the Sub-Basin. Eight in the Nevada portion with a connected population of 47,700 discharge wastes with an estimated population equivalent of 14,900 to watercourses and two in the California portion with a connected population of 2,600 discharge wastes with an estimated population equivalent of 1,400 to watercourses. Five additional communities in Nevada with a connected population of 16,400 and one in California with a connected population of 1,500 discharge wastes to irrigation fields or percolation beds so that pollution of surface waters is not a problem.

There are no known significant sources of industrial pollution in the California portion of

the Sub-Basin. There is one industry discharging organic wastes with a population equivalent of 3,500 and there are two industries discharging inorganic wastes to watercourses in the Nevada portion of the Sub-Basin.

There are six primary sewage treatment plants serving a population of about 15,400 in seven communities of the Nevada portion of the Sub-Basin and three primary plants serving a population of 4,100 in three communities of the California portion of the Sub-Basin. There are also three secondary sewage treatment plants serving a population of over 33,100 in the Nevada portion of the Sub-Basin. There are three communities with a population of over 15,500 with no treatment facilities in the Sub-Basin, all in the Nevada portion, but two of the communities are unsewered resort areas on Lake Tahoe, and the population figures are for peak summer loadings.

All recognized industries in the Sub-Basin have treatment facilities.

Five of the nine domestic sewage treatment plants in the Nevada portion of the Sub-Basin are considered by the State Department of Health to be adequate as to design capacity and degree of treatment provided and four are considered to be unsatisfactory. Operation of eight of the nine plants is considered to be satisfactory. Of the three industrial waste treatment plants in the Nevada portion, one is considered satisfactory and two unsatisfactory.

One of the three communities in the California portion of the Sub-Basin has provided sewage treatment facilities which, under the former permit system of the State Department of Public Health, were considered adequate as to design capacity and degree of treatment provided. However, under present California legislation, the Regional Water Pollution Control Board has primary responsibility for determination of adequacy of treatment works to meet its requirements for receiving waters or disposal areas. Two of the three treatment plants are considered inadequate. The operation of two of the three treatment plants is considered satisfactory. There are no known industrial waste treatment facilities in the California portion of the Sub-Basin.

Two new sewage treatment plants were completed and placed in operation during the first six months of 1950 in the Nevada portion of the Sub-Basin. The new complete treatment plant at Reno was designed for 16.5 M.G.D. which at 300 gallons per capita per day would give a design population of 55,000. The present population of Reno is nearly 32,400. The Nevada State Prison also completed and placed in operation in the first six months of 1950 a treatment plant designed to serve a population of 500.

The requirements for municipal waste treatment plants in the Nevada portion of the Sub-Basin have been reported by the State Department of Public Health as follows: three new plants to serve a population of over 15,500 with no treatment facilities at present, additions or enlargements to two existing plants serving a population of 11,200, and two plants to replace existing obsolete plants now serving a population of 3,200. Five existing domestic treatment plants serving a population of over 34,100 are considered to be satisfactory for present conditions. Additions or enlargements to existing plants are required at two industrial waste treatment plants in Nevada. One industrial waste treatment plant is considered to be adequate for present conditions.

The municipal waste treatment requirements for the California portion of the Sub-Basi are: replacement of one primary plant which serves a population of 1,400 and enlargements or additions to one primary plant serving a population of 1,300.

The status of required domestic waste treatment projects in Nevada is: plans now being prepared for one project, abatement ordered for one project and five projects inactive. In California, plans are being prepared for two projects.

Cost of needed waste treatment facilities is roughly estimated at $643,000 for Nevada and $94,000 for California or $737,000 total for the Sub-Basin.

Water from Lake Tahoe is widely used for domestic water supply purposes by communities and resorts along the shore. The lake is also used for livestock watering, irrigation, sport fishing, bathing, boating and other recreation. The bordering States of California and Nevada have long recognized the importance of maintaining the high quality of the Lake water and by mutual agreement have attempted to prevent discharge of any sewage or sewage effluent to the Lake. The rapidly growing recreational areas make disposal of sewage to individual subsurface irrigation systems increasingly difficult, however, and several communities are considering plans for construction of public sewer systems. High shoreline property values and the mountainous terrain rising rapidly from the shore make the provision of land disposal areas suitable for disposal of sewage effluents by land irrigation or percolation beds very difficult anywhere in the Lake Tahoe area. Present water quality is excellent.

Lake Tahoe overflows to the Truckee River which furnishes part of the domestic and industrial water supply for Truckee, Calif. and Reno, Nev. The water is chlorinated at Truckee and given complete treatment at Reno, but there are certain other small communities that use raw water from both the Truckee and Carson Rivers in spite of the objections to this practice by the State Department of Public Health. Other water uses in the Truckee and

Carson Rivers are livestock watering, irrigation, sport fishing, and other recreation. The water in both rivers is known to be of unsatisfactory quality for present uses in some places and actual nuisances exist on the Truckee River below Sparks, Nev. and on the Carson River below Carson City, Nev. and below Fallon, Nev.

Table A4. Sources of pollution, municipal

Municipalities*	Sources of pollution (in number of municipalities)	Population served by sewerage system	Amount of pollution discharged to watercourse (in terms of equivalent number of people)**
Having data on pollution load discharged to watercourse	16	68,215	16,310
Having population data available (Data on pollution load to watercourse incomplete or not available)	--	--	Not applicable
Total	16	68,215	--

*Includes incorporated or unincorporated municipalities, other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers; sanitary sewage wastes discharged by industry directly to watercourse.

Six of the 16 sources serving 17,907 of the 68,215 persons discharge wastes with an additional population equivalent of 16,970 to land.

**Includes industrial wastes discharged into municipal sewage systems.

Table B4. Sources of pollution industrial*

Industries	Source of pollution (in number of plants)	Amount of pollution discharged to watercourse (in terms of equivalent number of people)
Producing organic wastes	1	3,500
Producing organic wastes	0	Undetermined
Producing inorganic wastes	2	Not applicable
Producing wastes of undetermined type	0	Undetermined
Total	3	--

*Industries having separate outlets and discharging wastes directly to watercourse or land.

Table C4.

Existing treatment facilities, municipal

Degree of treatment provided	Number		Population served
	Municipalities*	Plants	
Primary	10	9	19,496
Secondary	3	3	33,158
No treatment	3	0	15,561

*Includes incorporated or unincorporated municipalities, other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers; sanitary sewage wastes discharged by industry directly to watercourse.

Table D_4. Existing treatment facilities, industrial*

Type industry	Number of plants	Number of industrial plants having:		
		Treatment facilities	No treatment facilities	Undetermined facilities
Manufacturing industries:				
Food and kindred products	1	1	--	--
Miscellaneous	1	1	--	--
Nonmanufacturing industries:				
Other mining industries.	1	1	--	--

*Industries having separate outlets and discharging wastes directly to watercourse.

Table E_4. Adequacy of existing treatment facilities

Existing treatment facilities	Number	Adequacy with relation to:					
		Capacity			Operation		
		Satisfactory	Unsatisfactory	Undetermined	Satisfactory	Unsatisfactory	Undetermined
Municipal	12	6	6	0	10	2	--
Industrial	3	1	2	0	1	2	0

Table F_4. Progress in pollution abatement

Year	Municipal		Industrial	
	Plants completed	Design population	Plants completed	Amount of waste treated (in terms of equivalent number of people)
1946	--	--	--	--
1947	--	--	--	--
1948	--	--	--	--
1949	--	--	--	--
1950	2	55,500	--	--

Table G_4. Requirements for municipal and industrial waste treatment plants*

Requirements	Municipal		Industrial
	Number	Population served by facilities	Number
New plant	3	15,561	--
Enlargement or additions to existing plant	3	12,489	2
Replace existing plant	3	4,553	--
No project required	6	35,612	1
Undetermined	0	--	--

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

Table H_4. Status of treatment works project to abate pollution, July 1, 1950

Status of project	Number	
	Municipal	Industrial
No formal action	5	1
Abatement ordered	1	--
Plans under preparation	3	--
Final plans approved	--	1
Construction awaiting financing	--	--
Under construction	--	--
Status undetermined	--	--

Table I_4. Project list* - municipalities and industries requiring improvements for abatement of pollution, July 1, 1950

Name**	Population served	Project requirements	Remarks
Nevada:			
Carson City.....	3,069	Enlargement or addition	--
Douglas Co.	7,500	New plant	Unsewered resort area where individual disposal practiced - collection and treatment advisable.
Fallon.....	2,393	Replace existing plant	--
Minden and Gardnerville.....	810	Replace existing plant	--
Sparks.....	8,170	Enlargement or addition	--
Virginia City.....	561	New plant	--
Washee Co.	7,900	New plant	Unsewered resort area where individual disposal practiced - collection and treatment advisable.
Stockmans Packing Plant, Reno.....	--	Enlargement or addition	Ind. P.E. of 3500 (E).
Milling near Silver City.....	--	Enlargement or addition	Ind. Tailings. No organic wastes.
California:			
California City A.....	1,350	Replace existing plant	--
California City B.....	1,250	Enlargement or addition	--

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

**The California municipalities listed as requiring projects have been coded because the recently established California State and Regional Water Pollution Control Boards have not had time to evaluate formerly determined waste treatment requirements.

CENTRAL NEVADA SUB-BASIN

Description and Economic Development

The Central Nevada Sub-Basin lies in the south central portion of the State. It is roughly triangular in shape and embraces 36,650 square miles, representing about 33.1 percent of the total area of the State. In the north north-south direction, the boundaries are approximately 400 miles apart. For the most part the Sub-Basin lies between 36° - 40° north latitude and 115° - 118° west longtitude.

The Sub-Basin is a high semi-arid plateau with numerous mountain ranges traversing the area in a general north-south direction. Elevations vary from 4,000 feet in the flat desert areas to 9,000 - 10,000 feet in the mountain regions.

Precipitation varies from 12 inches per year in the higher regions to 4 - 5 inches in the desert areas with a gradual increase from north to south. Temperatures increase from north to south with January and July averages in the north about 28° F. and 72° F. and in the south about 44° F. and 84° F. Maximum and minimum figures vary from 110° F. and -26° F. to 118° F. and 6° F.

There are no major water courses within the Sub-Basin. Mining would be considered the primary industry within the area. There are, however, small areas of agricultural activity where water is available. Stock raising also provides a portion of the income of the various counties making up the Sub-Basin.

The population of the Sub-Basin decreased from 11,100 in 1940 to 8,000 in 1950. This loss in population can be attributed to the decreased activity of the mining interests. In 1950, about 3,400 persons, or 42 percent of the population, were concentrated in the seven largest communities, most of them old mining centers.

Summary of Water Pollution Data

There are only three communities, Tonopah, Goldfield, and Eureka, with a combined population of slightly more than 2,200, and no industries, that could be considered as significant sources of pollution. Tonopah and Goldfield are the only communities with public sewer systems. At both places raw sewage is disposed of to land. Eureka has no public sewer system, but there are several individual disposal systems that are not operating properly.

On the over-all policy of providing at least primary treatment for those areas having sewer systems and no treatment, the State Department of Health advises at least primary treatment at Tonopah and Goldfield and a sewer system and some type of treatment for Eureka. This area is primarily desert and there is really no stream pollution problem. No formal action has been taken toward construction of the required works by any of the three communities. Total cost of the three treatment plants is roughly estimated at $79,000.

Table A-. Sources of pollution, municipal

Municipalities*	Sources of pollution (in number of municipalities)	Population served by sewerage system	Amount of pollution discharged to watercourse (in terms of equivalent number of people)**
Having data on pollution load discharged to watercourse	3	2,233	0
Having population data available (Data on pollution load to watercourse incomplete or not available)	--	--	Not applicable
Total	3	2,233	--

*Includes incorporated or unincorporated municipalities, other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers; sanitary sewage wastes discharged by industry directly to watercourse.

Population equivalent of 2,233 discharged to land.

**Includes industrial wastes discharged into municipal sewage systems.

Table B_5. Sources of pollution, industrial*

Industries	Sources of pollution (in number of plants)	Amount of pollution discharged to watercourse (in terms of equivalent number of people)
Producing organic wastes	0	0
Producing organic waste	0	Undetermined
Producing inorganic wastes	0	Not applicable
Producing wastes of undetermined type	0	Undetermined
Total	0	--

*Industries having separate outlets and discharging wastes directly to watercourse or land.

Table C_5.

Existing treatment facilities, municipal

Degree of treatment provided	Number		Population served
	Municipalities*	Plants	
Primary	--	--	--
Secondary	--	--	--
No treatment	3	0	2,233

*Includes incorporated or unincorporated municipalities, other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers; sanitary sewage wastes discharged by industry directly to watercourse.

Table D_5. Existing treatment facilities, industrial*

Type industry	Number of plants	Number of industrial plants having:		
		Treatment facilities	No treatment facilities	Undetermined facilities
Manufacturing industries..	0	--	--	--
Nonmanufacturing industries.....	0	--	--	--

*Industries having separate outlets and discharging wastes directly to watercourse or land.

Table E_5. Adequacy of existing treatment facilities

Existing treatment facilities	Number	Adequacy with relation to:					
		Capacity			Operation		
		Satisfactory	Unsatisfactory	Undetermined	Satisfactory	Unsatisfactory	Undetermined
Municipal	0	--	--	--	--	--	--
Industrial	0	--	--	--	--	--	--

Table F5. Progress in pollution abatement

Year	Municipal		Industrial*	
	Plants completed	Design population	Plants completed	Amount of waste treated (in terms of equivalent number of people)
1946	0	-- --	--	--
1947	0	-- --	--	--
1948	0	-- --	--	--
1949	0	-- --	--	--
1950	0	-- --	--	--

* There are no industries with separate outlets known to be discharging wastes of significance to the watercourses or land of the Central Nevada Sub-Basin.

Table G5. Requirements for municipal and industrial waste treatment plants*

Requirements	Municipal		Industrial
	Number	Population served by facilities	Number
New plant	3	2,233	0
Enlargement or additions to existing plant	--	--	--
Replace existing plant	--	--	--
No project required	--	--	--
Undetermined	--	--	--

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

Table H5. Status of treatment works project to abate pollution, July 1, 1950

Status of project	Number	
	Municipal	Industrial
No formal action	3	--
Abatement ordered	--	--
Plans under preparation	--	--
Final plans approved	--	--
Construction awaiting financing	--	--
Under construction	--	--
Status undetermined	--	--

Table I5. Project list* - municipalities and industries requiring improvements for abatement of pollution, July 1, 1950

Name	Population served	Project requirements	Remarks
Nevada:			
Eureka.....	543	New plant	--
Tonopah.....	1,301	New plant	--
Goldfield.....	329	New plant	--

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

SEVIER RIVER SUB-BASIN

Description and Economic Development

The Sevier River Sub-Basin is bounded on the east, south, and west by the Colorado drainage area and in the north by the Great Salt Lake area. It covers 25,000 square miles, 19,800 of which are in Utah, and 5,200 in Nevada.

The eastern portion contains several valleys which have been developed for agriculture, the most important of which is the Sevier River Valley. The western portion of the Sub-Basin consists of alternate waste land and barren mountains. Elevations vary from 4,500 feet above sea level at Sevier Lake to peaks ranging from 10,000 to 12,000 feet along both the eastern and western boundaries. There is one peak of over 13,000 feet elevation in the Nevada portion of the Sub-Basin, but the major economic development occurs at elevations between 5,300 and 5,800 feet above sea level.

The Sevier River runs north along the eastern edge of the Sub-Basin then turns southwest and empties into Sevier Lake. The lake has no outlet and water reaching it is lost to beneficial use because of the high concentration of salts. The San Pitch River, a tributary of the Sevier, is the second most prominent stream in the Sub-Basin and it is dry during portions of the year.

Annual precipitation varies from 18 inches in the northeastern portion of the Sub-Basin to eight inches over the western portion. Average January temperatures for the Sub-Basin are around 24°F., and average July temperatures are about 70°F. The growing season is approximately 110 days.

The total 1950 population of the Sub-Basin is 62,600. This is a decrease of 4,500 from the 1940 population of 67,100. This emigration was begun by wartime manpower mobilization and encouraged in postwar years by greater opportunities in other sections of the nation and the closing of several mines in the area. The Sub-Basin is characteristic of Utah development in that farmers live in small communities rather than on isolated farms and ranches.

Summary of Water Pollution Data

There are 13 sewered communities which serve 18,700 people in the Sub-Basin. Nine of these communities serving nearly 15,000 people discharge wastes having a total population equivalent of 12,300 to watercourses. Four other communities serving 3,700 persons discharge a total population equivalent of 3,700 to land. Only three of the sewered communities provide treatment works for their collected wastes. One of these plants serves 3,500 people with primary treatment and the other two, each serving 100 people, consist of septic tanks and subsurface irrigation fields. The two small plants are considered adequate as to both design and operation, and the larger plant is considered adequate as to operation but inadequate as to degree of treatment.

Progress in pollution abatement has been slow in this Sub-Basin. Only one treatment plant has been constructed in the postwar years. That plant constructed in 1948 was designed for a population of 3,500.

Nine new plants to serve a total of 12,500 people are required in this Sub-Basin. Included in this number is one community of 1,000 people where collection and treatment of sewage are both needed. One plant serving 3,500 persons should provide a higher degree of treatment. Four communities with some 3,700 people have no immediate requirements.

It is estimated that these needed municipal sewage treatment plants would cost approximately $456,000. This represents initial outlay for treatment plants only and does not include the cost of sewers and interceptors or planning and engineering costs.

No formal action has been taken in seven communities where a project is required. Two others have plans under preparation and the courts have ordered abatement of pollution in one community.

There are only 20 industrial plants which are known to have separate outfalls in this Sub-Basin. Sixteen of these plants discharge organic wastes with a total population equivalent of approximately 133,900. There are six plants which provide for treatment of their wastes. The adequacy of design and degree of treatment is unsatisfactory at four and undetermined at two. The adequacy of operation is satisfactory at two, unsatisfactory at two, and undetermined at two.

The only construction of industrial waste treatment facilities in the Sub-Basin in the postwar years was in 1948 when one plant installed treatment facilities. The requirements now considered necessary for abatement of industrial waste pollution are six new plants, four enlargements of, or additions to, existing facilities and additional study of ten industries where requirements are undetermined.

Lack of information has prevented the determination of an estimate of the cost of needed industrial waste pollution abatement measures.

There has been no formal abatement action for ten of the contributing industries and the status of ten others is undetermined.

Waste discharge to irrigation canals is general in this Sub-Basin, and the Utah State Department of Health indicates that these waters are unsatisfactory for subsequent use because of the potential health hazards accompanying general agricultural use of polluted water. Domestic water supplies are derived from springs and wells.

There are no large towns in the Sub-Basin, however, local problems exist at the sewer outfalls of most of the sewered communities.

Table A_6. Sources of pollution, municipal

Municipalities*	Sources of pollution (in number of municipalities)	Population served by sewerage system	Amount of pollution discharged to watercourse (in terms of equivalent number of people)**
Having data on pollution load discharge to watercourse	13	18,685	12,250
Having population data available (Data on pollution load to watercourse incomplete or not available)	--	--	Not applicable
Total	13	18,685	--

*Includes incorporated or unincorporated municipalities, other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers; sanitary sewage wastes discharged by industry directly to watercourse.

Two of the 13 communities discharge the septic tank effluent of 200 persons to percolation beds. One of the 13 communities which serves 1,245 runs raw sewage out on the ground, and another serving 2,290 persons discharges raw sewage with mine tailings to a dry wash. Thus an additional population equivalent of 3,680 is discharged to land.

**Includes industrial wastes discharged into municipal sewage systems.

Table B_6. Sources of pollution, industrial*

Industries	Sources of pollution (in number of plants)	Amount of pollution discharged to watercourse (in terms of equivalent number of people)
Producing organic wastes	16	133,850
Producing organic wastes	0	Undetermined
Producing inorganic wastes	0	Not applicable
Producing wastes of undetermined type	4	Undetermined
Total	20	--

*Industries having separate outlets and discharging wastes directly to watercourse or land.

Table C_6.

Existing treatment facilities, municipal

Degree of treatment provided	Number		Population served
	Municipalities*	Plants	
Primary	1	1	3,500
Secondary	2	2	200
No treatment	10	--	14,985

*Includes incorporated or unincorporated municipalities, other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers; sanitary sewage wastes discharged by industry directly to watercourse.

Table D_6. Existing treatment facilities, industrial*

Type industry	Number of plants	Number of industrial plants having:		
		Treatment facilities	No treatment facilities	Undetermined facilities
Manufacturing industries:				
Food and kindred products	16	5	11	--
Miscellaneous	2	1	1	--
Nonmanufacturing industries:				
Mine drainage	2	--	--	2

*Industries having separate outlets and discharging wastes directly to watercourse or land.

Table E_6. Adequacy of existing treatment facilities

Existing treatment facilities	Number	Adequacy with relation to:					
		Capacity			Operation		
		Satisfactory	Unsatisfactory	Undetermined	Satisfactory	Unsatisfactory	Undetermined
Municipal	3	2	1	--	3	--	--
Industrial	8	--	4	2	2	2	2

Table F_6. Progress in pollution abatement

Year	Municipal		Industrial	
	Plants completed	Design population	Plants completed	Amount of waste treated (in terms of equivalent number of people
1946	--	--	--	--
1947	--	--	--	--
1948	1	3,500	1	Unknown
1949	--	--	--	--
1950	--	--	--	--

Table G_6. Requirements for municipal and industrial waste treatment plants***

Requirements	Municipal		Industrial
	Number	Population served by facilities	Number
New plant	9*	12,450*	6
Enlargement or additions to existing plant	1	3,500	4
Replace existing plant	--	--	--
No project required	4**	3,735	--
Undetermined	0	--	10

*Includes one community of 1,000 people which is not now sewered and appears here for the first time in these tables.

**Two of these communities do not have treatment facilities and have no need for treatment at present.

***The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

Table H_6. Status of treatment works project to abate pollution, July 1, 1950

Status of project	Number	
	Municipal	Industrial
No formal action	7	10
Abatement ordered	1*	--
Plans under preparation	2	--
Final plans approved	--	--
Construction awaiting financing	--	--
Under construction	--	--
Status undetermined	--	10

*Ordered by court action as a result of civil suit. Action not brought by State agency.

Table I_6. Project list* - municipalities and industries requiring improvements for abatement of pollution, July 1, 1950

Name	Population served**	Project requirements	Remarks
Utah:			
Beaver	500	New plant	Existing septic tank
Cedar City	3,500	Enlargement or addition	Existing Imhoff Tank
Delta	1,100	New plant	--
Eureka	500	--	--
Gunnison	50	New plant	Existing septic tank
Milford	1,800	New plant	Existing septic tank
Richfield	3,000	New plant	Existing septic tank
Salina	1,000	New plant	Existing septic tank
Nevada:			
Ely	3,500	New plant	Existing septic tank
East Ely	1,000	New plant	No sewers but sewerage and sewage treatment urgently needed
Utah:			
American Fruit Products	4,000	Enlargement or addition	Richfield
Brinkerhoff Creamery	150	Undetermined	Beaver
Brinkerhoff Creamery	500	Undetermined	Mt. Pleasant
Brinkerhoff Creamery	1,000	Enlargement or addition	Panguitch
Ephraim Creamery	100	New plant	Ephraim
Eureka Mine	--	Undetermined	Eureka
Garfield Sugar Factory	17,000	Undetermined	Gunnison
Gunnison Turkey Farm	5,000	New plant	Gunnison
Hercules Packing Co.	350	New plant	Cedar City
Western Dairy Creamery	400	Undetermined	Aurora
Western Dairy Creamery	400	Undetermined	Manti
Western Dairy Creamery	150	Enlargement or addition	Elsinor
South Utah Dairy Assn.	250	New plant	Parowan
Turkey Plant	5,000	New plant	Morroni
United States Gypsum	--	Undetermined	Sigurd
University Dairy	50	Enlargement or addition	Morroni
Uranium Mines	--	Undetermined	Marysvale
Valley Packing Co.	50	Undetermined	Beaver
Western Creamery Co.	400	New plant	Monroe
Western Gypsum	--	Undetermined	Sigurd

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.
**In case of industry figures represent population equivalents.

WALKER RIVER SUB-BASIN

Description and Economic Development

The Walker River Sub-Basin is located along the Nevada-California State Line adjoining the slopes of the Sierra Nevada Mountains. The total area of the Sub-Basin is approximately 4,455 square miles, 3,445 in Nevada and 1,010 in California. The Sub-Basin covers only the drainage basin of the Walker River which rises in California on the eastern slopes of the Sierra Nevada Mountains and flows northeast into Nevada.

The Walker River and tributaries pass through several valleys of approximately 4,000 feet in elevation which are separated by low mountain ranges of approximately 5,000-6,000 feet. After passing through Mason Valley, the largest, the main stream turns eastward and then south, discharging into Walker Lake. Four valleys are traversed by the Walker River and its two main tributaries, the East and West Walker Rivers. These valleys are known as Big Meadows on the East Walker River, Antelope and Smith Valleys on the West Walker River, and Mason Valley on the Walker River.

In the arid Nevada portion of the Sub-Basin, precipitation is very irregular with average annual values ranging from 5 to 7 inches. The average January temperatures fall between 30° and 34° F., and the average July values fall between 70° and 78° F. Maximum and minimum temperatures noted have been 109° and -26° F.

In the mountainous California section, the average annual rainfall is 10.14 inches at Bridgeport and 14.48 inches at Bodie. The average January temperature at Bodie is 27.5° F., and the average July temperature is 56.6° F. The maximum and minimum temperatures noted at Bodie have been 93° F. and -3° F., respectively.

The population in the Sub-Basin was approximately 4,900 in 1940, over 4,200 in the Nevada portion and over 600 in the California portion. In 1950 the population was 8,600, of which over 8,000 were in the Nevada portion and nearly 600 in the California portion. The population densities in 1950 were 2.3 persons per square mile in the Nevada portion and 0.55 persons per square mile in the California portion. The large increase in population in the Nevada portion of the Sub-Basin from 1940 to 1950 was largely due to an influx of civilian employees and naval personnel working at the U. S. Navy Ammunition Depot located near Hawthorne, Nev.

In the Nevada portion of the Sub-Basin, agricultural activities including livestock grazing, irrigated truck and field crops, dairying and poultry raising are the most important pursuits. Mining is the next important industry and, although activity in the mines has decreased in recent years, considerable income is still being derived from mines in the area. There are also some poultry dressing plants and one slaughterhouse in the area.

In the California portion of the Sub-Basin the mountainous terrain and numerous lakes and streams make the area one of the favorite recreational sections of that state. Numerous lodges, cabins, and camp grounds have been developed and are usually filled during the hunting, fishing, and tourist season. It is estimated that 500,000 persons spend vacations in the area each year. Livestock grazing, lumbering, and mining are also minor industries.

The waters of the Walker River System are used primarily for irrigation, livestock watering, fishing, bathing, and other recreation. There are no known industrial or domestic water supplies taken from this river system.

Summary of Water Pollution Data

There are five possible sources of pollution in the Nevada portion of the Sub-Basin. One meat packing industry located on the banks of the Walker River near Yerington, Nevada, discharges wastes into ponds 250 feet to 300 feet from the river. The town of Yerington, serving approximately 1200 persons, utilizes a large septic tank discharging effluent across two irrigation ditches into a sand bar and slough. The effluent travels by drain ditch and at one point is approximately 200 feet from the Walker River. Schurz, Nev., Walker River Indian Reservation, has a collection system and septic tank serving approximately 200 persons. The effluent from this system sinks into a fault in the ground surface approximately 75 to 100 feet from the Walker River. Babbitt, Nev., serves approximately 3,000 persons and utilizes twin Imhoff tanks with auxiliary sludge digestion and sludge drying beds. Effluent is discharged into sand filtration ponds approximately 3/4 miles from the south end of Walker Lake. Wells one-quarter mile from these filtration ponds have never shown any trace of contamination. Hawthorne, Nev., serves approximately 1,600 persons and has

a primary treatment plant utilizing bar screens, mechanical clarification, separate sludge digestion, sludge drying beds and filtration ponds. These ponds are located approximately one mile from the south end of Walker Lake.

The ponding facilities of the meat packing plant near Yerington are thought to be sufficient for the needs of the industry at its present rate of production. There has been no indication that the activities there have made the waters unfit for indicated uses. No project is required at this time.

The communities of Yerington and Schurz discharge effluent from septic tanks very near and into the Walker River. Replacement of the facilities for both communities is indicated.

Hawthorne applies the effluent from a primary plant into improved and maintained sand filtration beds. This is considered to be secondary treatment and a satisfactory method. The plant proper should have improvements and make better utilization of existing facilities.

Babbitt, Nev. is discharging effluent into improved and maintained sand filtration beds. The entire system here is operating in a satisfactory manner and no project is required.

There are no significant sources of pollution known to exist in the California portion of the Sub-Basin. Bridgeport, the largest community, has a population of only 200 and has no public sewer system. Considerable difficulty has been experienced with individual septic tanks and cesspools due to the high water table in the valley, and plans are being prepared for a sewer system and sewage treatment facilities. All of the motels and resorts in the area have their own sewerage systems, generally septic tanks and subsurface irrigation fields.

The cost of replacing two plants to provide complete treatment for a design population of 1,700 and of making improvements to one existing complete treatment plant for a design population of 1,900 in the Nevada portions of the Sub-Basin is estimated at $77,000. The cost of providing treatment in the California portion of the Sub-Basin for a design population of 300 in the one community that may soon put in a public sewer system is estimated at $18,00. Total cost for needed waste treatment works is estimated at $95,000 for the Sub-Basin.

Table A-. Sources of pollution, municipal

Municipalities*	Sources of pollution (in number of municipalities)	Population served by sewerage system	Amount of pollution discharged to watercourse in terms of equivalent number of people)**
Having data on pollution load discharged to watercourse	4	4,782	130
Having population data available (data on pollution load to watercourse incomplete or not available)	--	--	Not applicable
Total	4	4,782	--

*Includes incorporated or unincorporated municipalities, other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers; sanitary sewage wastes discharged by industry directly to watercourse.

Three of the four communities serving 4,782 of the 5,482 persons discharge wastes with a population equivalent of 4,[illegible]0 to land.

**Includes industrial wastes discharged into municipal sewage systems.

Table B-. Sources of pollution, industrial*

Industries	Sources of pollution (in number of plants)	Amount of pollution discharged to watercourse (in terms of equivalent number of people)
Producing organic wastes	0	None
Producing organic wastes	1	Undetermined
Producing inorganic wastes	0	Not applicable
Producing wastes of undetermined type	0	Undetermined
Total	1	--

*Industries with separate outlets and discharging wastes directly to watercourse or land.

Table C_7.

Existing treatment facilities, municipal

Degree of treatment provided	Number		Population served
	Municipalities*	Plants	
Primary	2	2	1,382
Secondary	2	2	4,600
No treatment	0	0	0

*Includes incorporated and unincorporated municipalities, other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers; sanitary sewage wastes discharged by industry directly to watercourse.

Table D_7. Existing treatment facilities, industrial*

Type industry	Number of plants	Number of industrial plants having:		
		Treatment facilities	No treatment facilities	Undetermined facilities
Manufacturing industries: Food and kindred products.....	1	1	--	--

*Industries having separate outlets and discharging wastes directly to watercourse or land.

Table E_7. Adequacy of existing treatment facilities

Existing treatment facilities	Number	Adequacy with relation to:					
		Capacity			Operation		
		Satisfactory	Unsatisfactory	Undetermined	Satisfactory	Unsatisfactory	Undetermined
Municipal	4	1	3	--	1	3	--
Industrial	1	1	--	--	1	--	--

Table F_7. Progress in pollution abatement*

Year	Municipal		Industrial	
	Plants completed	Design population	Plants completed	Amount of waste treated (in terms of equivalent number of people
1946	--	--	--	--
1947	--	--	--	--
1948	--	--	--	--
1949	--	--	--	--
1950	--	--	--	--

* All significant sources of pollution have been provided with treatment facilities prior to 1946.

One municipal plant was completed in 1947 to serve a design population of 800, and one plant was completed in 1949 to serve a design population of 4,000.

The treatment requirements and project status of the fish hatchery are not known.

The principal uses of the water resources of the Sub-Basin are public water supply, sport fishing and other recreation. Due to the lack of industrial development there is not much demand for industrial water supply within the Sub-Basin. The irrigation water use is relatively small.

The public water supply use of the water resources within the Sub-Basin is not great since relatively few people live in the area. The city of Bishop and most of the smaller communities and camps depend upon surface water supplies for domestic use, however. Water exported from the Sub-Basin for domestic and industrial use has been of the utmost importance in the rapid development of the Los Angeles Metropolitan Area.

In 1908 it was recognized that the Los Angeles River could no longer furnish a dependable water supply for the rapidly growing city of Los Angeles, and construction was started on the Los Angeles-Owens River Aqueduct, 250 miles long, to carry Owens River water to Los Angeles. This project was completed in 1913, but the city developed so rapidly that additional water was soon needed. In 1930, the Mono Basin watershed 350 miles north of Los Angeles was also developed to augment the Owens River supply. The flow of five streams, Walker, Parker, Rush, Leevining, and Gibbs Creeks, that formerly drained to Mono Lake as well as much of the flow from the Owens River is now diverted from the Sub-Basin to the Los Angeles area.

Water quality in general is believed to be satisfactory, although there is a possibility of contamination from the numerous fishermen, hunters, and recreationists who frequent the area during the fishing season. The Regional Water Pollution Control Board and the State Department of Public Health are now conducting an extensive investigation based largely on coliform indices, to determine if fishermen and recreational use of catchment areas is causing significant contamination of surface waters. Numerous samples of water will be examined before, during, and after the fishing season. Interpretation of the significance of results will await completion of the seasonal samplings and laboratory examinations.

Table Ag. Sources of pollution, municipal

Municipalities*	Sources of pollution (in number of municipalities)	Population served by sewerage system	Amount of pollution discharged to watercourse (in terms of equivalent number of people)**
Having data on pollution load discharged to watercourse	4	5,000	--
Having population data available (Data on pollution load to watercourse incomplete or not available)	--	--	Not applicable
Total	4	5,000	--

*Includes incorporated or unincorporated municipalities, other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers; sanitary sewage wastes discharged by industry directly to watercourse.

All sewered communities in this Sub-basin discharge wastes to land. The estimated population equivalent of the wastes discharged to land is 3,250.

**Includes industrial wastes discharged into municipal sewage systems.

Table Bg. Sources of pollution, industrial*

Industries	Sources of pollution (in number of plants)	Amount of pollution discharged to watercourse (in terms of equivalent number of people)
Producing organic wastes	--	--
Producing organic wastes	1	Undetermined
Producing inorganic wastes	1	Not applicable
Producing wastes of undetermined type	--	Undetermined
Total	2	--

*Industries having separate outlets and discharging wastes directly to watercourse or land.

Table G_6. Requirements for municipal and industrial waste treatment plants*

Requirements	Municipal		Industrial
	Number	Population served by facilities	Number
New plant	[illegible]	--	--
Enlargement or additions to existing plant	1	1,600	--
Replace existing plant	2	1,382	--
No project required	1	3,000	1
Undetermined	--	--	--

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

Table H_7. Status of treatment works project to abate pollution, July 1, 1950

Status of project	Number	
	Municipal	Industrial
No formal action	3	--
Abatement ordered	--	--
Plans under preparation	--	--
Final plans approved	--	--
Construction awaiting financing	--	--
Under Construction	--	--
Status undetermined	--	--

Table I_7. Project list* - municipalities and industries requiring improvements for abatement of pollution, July 1, 1950

Name	Population served	Project requirements	Remarks
Nevada:			
Sonora	250	Replace sewage treatment plant	--
Yerington	1,150	Enlarge sewage treatment plant	--
Hawthorne	1,500	Enlarge sewage treatment plant	--

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

OWENS RIVER SUB-BASIN

Description and Economic Development

The Owens River Sub-Basin comprises a long narrow drainage area in Mono and Inyo Counties of California, extending about 150 miles in a northwest direction and having an average width of approximately 25 miles. This watershed parallels the Sierra Nevada Mountains that form its western boundary, and the White and Inyo Mountains on its eastern side. These mountains drain into Owens River which extends almost throughout the length of the Sub-Basin emptying into Owens Lake to the southward. In the northern part, Mono Lake is the receiving basin of a drainage system that starts in the surrounding mountainous regions.

Pronounced physiographic and climatic contrasts characterize the Owens River Sub-Basin. Altitudes range from Mt. Whitney, elevation 14,496 feet, to valley areas around 4,700 feet above sea level. Hundreds of small streams start near the Sierra divide, the western boundary of the Sub-Basin, and flow toward Owens Valley. These waters are mostly trapped for power, irrigation, and water supply. The Owens River runs south through the northern end of the Owens Valley into Tinnemaha Reservoir, which supplies water to the City of Los Angeles through a 250-mile aqueduct. There is also considerable hydroelectric power development, including plants in Leevining Canyon and at Silver Lake that generate power for transmission to Southern California, over one of the world's longest high voltage transmission lines.

The region is sparsely populated, the 1950 population being slightly over 7,300 or 33 percent more than in 1940. The area is widely accessible by highways from Lake Tahoe, Carson City, Reno, Yosemite National Park, San Bernardino, Los Angeles, Bakersfield and Salt Lake City. The largest city in the Sub-Basin is Bishop that has a 1950 population of about 2,900. It is a supply point and center of farming, water power, recreation and mining.

Ninety-eight percent of the land in the Sub-Basin is publicly owned, mostly within Inyo National Forest and Toiyabe National Forest. The northern section is mountainous and extremely rugged. Famous trails and hunting sites occupy this area and overlook Mono Lake, known as the "Dead Sea of America." This unusual body of water is at an elevation of 6,426 feet and has no outlet. Its waters contain carbonate and sulphate of soda, sodium chloride, borax and other salts. The only permanent animal life is the brine shrimp.

The low Sierra slopes are partly covered with coniferous forests which include stands of Jeffrey pine. However, lumbering is undeveloped in such remote areas. This is indeed fortunate for the recreational value of the area is thereby greatly enhanced. The section lying along the eastern side of the Sierra crest is one of the finest for recreation in California, having numerous small lakes with excellent trout fishing.

Agricultural products are limited almost exclusively to hay and livestock, including beef, sheep, wool, and dairy products.

This Sub-Basin lies in a highly mineralized belt. It is unusually rich in saline deposits (borates, potash, salt and soda) and also has valuable deposits of gold, lead, silver, and tungsten. The unusual deposit of andalusite in Dry Creek Canyon on the west slope of the White Mountains is reputed to be the largest in the world.

Summary of Water Pollution Data

There are four sewered communities with a total connected population of 5,000 in the Sub-Basin. Wastes with a population equivalent of 3,300 are discharged from these communities and disposed of to percolation beds or used for irrigation of crops. No wastes from sewered communities reach surface streams. There are eight additional recreational or industrial camps with a combined population of approximately 750 that discharge wastes to subsurface irrigation fields or percolation beds. Inorganic wastes from the one large industry in the Sub-Basin are disposed of to land. So far as is known, the wastes from one fish hatchery are the only wastes of significance being discharged to surface waters.

All of the four sewered communities have provided primary treatment for their wastes and dispose of them to land so that no wastes enter surface streams. The one significant industry and one fish hatchery have also provided treatment for their wastes.

The four treatment plants serving the four sewered communities are considered to be adequate as to design capacity and degree of treatment provided. Operation of the four plants is also considered to be satisfactory. The waste disposal facilities at the one industry are also considered to be satisfactorily designed and operated, but the treatment provided at the fish hatchery is unsatisfactory.

Excellent progress has been made on construction of treatment works in recent years.

One municipal plant was completed in 1947 to serve a design population of 800, and one plant was completed in 1949 to serve a design population of 4,000.

The treatment requirements and project status of the fish hatchery are not known.

The principal uses of the water resources of the Sub-Basin are public water supply, sport fishing and other recreation. Due to the lack of industrial development there is not much demand for industrial water supply within the Sub-Basin. The irrigation water use is relatively small.

The public water supply use of the water resources within the Sub-Basin is not great since relatively few people live in the area. The city of Bishop and most of the smaller communities and camps depend upon surface water supplies for domestic use, however. Water exported from the Sub-Basin for domestic and industrial use has been of the utmost importance in the rapid development of the Los Angeles Metropolitan Area.

In 1908 it was recognized that the Los Angeles River could no longer furnish a dependable water supply for the rapidly growing city of Los Angeles, and construction was started on the Los Angeles-Owens River Aqueduct, 250 miles long, to carry Owens River water to Los Angeles. This project was completed in 1913, but the city developed so rapidly that additional water was soon needed. In 1930, the Mono Basin watershed 350 miles north of Los Angeles was also developed to augment the Owens River supply. The flow of five streams, Walker, Parker, Rush, Leevining, and Gibbs Creeks, that formerly drained to Mono Lake as well as much of the flow from the Owens River is now diverted from the Sub-Basin to the Los Angeles area.

Water quality in general is believed to be satisfactory, although there is a possibility of contamination from the numerous fishermen, hunters, and recreationists who frequent the area during the fishing season. The Regional Water Pollution Control Board and the State Department of Public Health are now conducting an extensive investigation based largely on coliform indices, to determine if fishermen and recreational use of catchment areas is causing significant contamination of surface waters. Numerous samples of water will be examined before, during, and after the fishing season. Interpretation of the significance of results will await completion of the seasonal samplings and laboratory examinations.

Table Ag. Sources of pollution, municipal

Municipalities*	Sources of pollution (in number of municipalities)	Population served by sewerage system	Amount of pollution discharged to watercourse (in terms of equivalent number of people)**
Having data on pollution load discharged to watercourse	4	5,000	--
Having population data available (Data on pollution load to watercourse incomplete or not available)	--	--	Not applicable
Total	4	5,000	--

*Includes incorporated or unincorporated municipalities, other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers; sanitary sewage wastes discharged by industry directly to watercourse.

All sewered communities in this Sub-basin discharge wastes to land. The estimated population equivalent of the wastes discharged to land is 3,250.

**Includes industrial wastes discharged into municipal sewage systems.

Table Bg. Sources of pollution, industrial*

Industries	Sources of pollution (in number of plants)	Amount of pollution discharged to watercourse (in terms of equivalent number of people)
Producing organic wastes	--	--
Producing organic wastes	1	Undetermined
Producing inorganic wastes	1	Not applicable
Producing wastes of undetermined type	--	Undetermined
Total	2	--

*Industries having separate outlets and discharging wastes directly to watercourse or land.

Table C_8.

Existing treatment facilities, municipal

Degree of treatment provided	Number		Population served
	Municipalities*	Plants	
Primary	4	4	5,000
Secondary	--	--	--
No treatment	--	--	--

*Includes incorporated or unincorporated municipalities, other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers; sanitary sewage wastes discharged by industry directly to watercourse.

Table D_8. Existing treatment facilities, industrial*

Type industry	Number of plants	Number of industrial plants having:		
		Treatment facilities	No treatment facilities	Undetermined facilities
Manufacturing industries: Miscellaneous.....	1	1	--	--
Nonmanufacturing industries: Mine drainage.....	1	1	--	--

*Industries having separate outlets and discharging wastes directly to watercourse or land.

Table E_8. Adequacy of existing treatment facilities

Existing treatment facilities	Number	Adequacy with relation to:					
		Capacity			Operation		
		Satisfactory	Unsatisfactory	Undetermined	Satisfactory	Unsatisfactory	Undetermined
Municipal	4	4	--	--	4	--	--
Industrial	2	1	1	--	1	1	--

Table Fg. Progress in pollution abatement

Year	Municipal		Industrial	
	Plants completed	Design population	Plants completed	Amount of waste treated (in terms of equivalent number of people
1946	--	--	--	--
1947	1	800	--	--
1948	--	--	--	--
1949	1	4,000	--	--
1950	--	--	--	--

Table Ga. Requirements for municipal and industrial waste treatment plants*

Requirements	Municipal		Industrial
	Number	Population served by facilities	Number
New systems	--	--	--
Enlargement of existing inadequate plant	--	--	--
Existing inadequate plant	--	--	--
No project received	4	9,	1
Undetermined	--	--	1

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

Table Hg. Status of treatment works project to abate pollution, July 1, 1950

Status of project	Number	
	Municipal	Industrial
In formulation	--	--
Abatement ordered	--	--
Plans under preparation	--	--
Final plans approved	--	--
Construction awaiting financing	--	--
Under construction	--	--
Status undetermined	--	1

Table Ia. Project list - Municipalities and industries requiring abatement for pollution, July 1, 1950

State	Population served	Project requirements	Remarks
	NO KNOWN PROJECTS REQUIRED		

MOJAVE DESERT SUB-BASIN

Description and Economic Development

The Mojave Desert Sub-Basin is the largest one in California, comprising an area of 22,480 square miles. It includes parts of the counties of Mono, Inyo, Kern, San Bernardino, and Los Angeles. Desert areas of the Great Basin bound the Sub-Basin on the north, east, and southeast, the northeastern boundary being the California-Nevada State line. The west and southwest boundaries are the San Bernardino, San Gabriel, Tehachapi, El Paso and Inyo Mountains. Practically all of the area consists of barren desert broken by scattered mountain ranges. Most of the land is publicly owned including 514,000 acres in the Death Valley National Monument. National forests cover the ranges on the west and southwest borders and provide storage reservoirs for water and important recreational centers.

Except in the high mountains, streams and lakes of the Sub-Basin are dry during most of the year. The principal natural watercourse in the Sub-Basin is the Mojave River (length about 120 miles) that originates in the San Bernardino Mountains in the southern part of the area, flows north to Barstow, then in a northeasterly direction until it is lost in the dry lakes of the desert. The second major watercourse is the Amargosa River which originates in the Death Valley National Monument, between the Panamint Mountains and the Amargosa Range, flows in a southeasterly direction to the southern sector of these mountains, and then swings to the north. The Los Angeles aqueduct extends southward along the western border of the Sub-Basin carrying water from the Owens River Sub-Basin to the City of Los Angeles.

Physiographically, the Sub-Basin consists of broad, alluvial plains sloping away from irregular barren hills and mountains, widely considered to be remnants of erosion. The greater part of the Mojave Desert is covered by alluvium. The known geologic conditions indicate that it is underlain largely by metamorphic and igneous rocks, with intervening areas covered by continental sediments, such as lake beds, mud flows, and alluvium. The major source of surface water is the San Bernardino Range, the northern slope of which is drained by the Mojave River.

The climate is very arid, annual precipitation ranging from about 0 to 5 inches in the valleys, with extremely low humidity, high summer temperatures, and great diurnal range in temperature. Approximately 60 percent of the precipitation occurs in the months of December, January, February and March.

The present population of the Sub-Basin is 41,700 an increase of 60 percent during the past decade. The largest city is Barstow (population 6,140).

Agricultural activities in the Sub-Basin are limited mainly to the southeastern sector in the Mojave River Basin. The construction of reservoirs and irrigation developments below the mountain forks that converge to form the Mojave River has favored agricultural developments.

In the Mojave River Valley, the use of irrigation works started before 1870. Since then, there have been irrigation companies and districts in existence for varying periods with the result that irrigated acreages have varied greatly in number. In 1918, there were 9,870 acres; in 1929, 6,019 acres.

Estimated annual mean stream discharges for the 29-year period 1905-1934 at the following gaging stations - West Fork Mojave River, East Fork Mojave River, and Mojave River below Forks - are 53,300, 57,000 and 90,300 acre-feet, respectively.

Mineral production in the desert provides an important source of revenue to the State. Principal minerals include sand and gravel, talc, soda ash and trona, silver, gold, copper, iron ore, clays and borates.

The Valley is well supplied with transportation being traversed by main lines of the Santa Fe and the Union Pacific Railroads and also by two main State and Federal highways. Much of the area of the Valley has been taken up by homesteads and desert entries. Improved water supply and increased recreational demands have resulted in recent migrations from the coastal area to attractive areas along the southwest fringes of the desert.

Summary of Water Pollution Data

There are 23 communities in the Sub-Basin including military installations, other legal bodies, institutions, resorts, and camps discharging waste from sewerage systems. The actual connected population of the 23 communities is nearly 42,000. The population equivalent of the wastes discharged after treatment is estimated to be 21,600. Of this 3,000 goes to watercourses and 18,600 goes to land.

There are ten military installations included in the 23 communities, where the population could increase rapidly in case of an emergency. Of the ten military installations, three

are Air Force, four are Marine, and three are Naval Ordinance Stations. These installations serve a population of 21,000 at this writing, discharging wastes with an estimated population equivalent of 10,700 after treatment, 10,500 of which goes to land and 200 of which goes to the Mojave River.

Table A9. Sources of pollution, municipal

Municipalities*	Sources of pollution (in number of municipalities)	Population served by sewerage system	Amount of pollution discharged to watercourse (in terms of equivalent number of people)**
Having data on pollution load discharged to watercourse***	4	11,130	3,010
	2	30,825	18,960
Having population data available (Data on pollution load to watercourse incomplete or not available)	None	None	Not applicable
Total	23	41,955	--

*Includes incorporated or unincorporated municipalities, other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers; sanitary sewage wastes discharged by industry directly to watercourse.

**Includes industrial wastes discharged into municipal sewage systems.

***In the arid west sewage collection and treatment systems discharge not only to watercourses where pollution of surface waters may be a problem but also to land where pollution of underground waters may occur. Accordingly, sources of pollution are broken down into these two categories and listed as such in this table.

1"To watercourses".

2"To land".

There are 22 treatment plants in the Sub-Basin treating wastes from 22 of the 23 communities. One community has no treatment and discharges its waste on land. Four of the treatment plants, serving a population of 6,200, provide primary treatment, and 18 of the plants, serving a population of 35,500 provide secondary treatment.

Fourteen municipal treatment plants are considered to be satisfactory as to design capacity and degree of treatment provided. There are eight plants considered unsatisfactory either as to capacity or degree of treatment. Seventeen of the treatment plants are considered to be satisfactorily operated and five unsatisfactorily operated.

New waste treatment facilities are required for three communities with a combined population of 8,350 to replace existing facilities, and for one community with population of 300 which now has no treatment facilities. Enlargement or additions to existing plants are needed in five communities with a combined population of 9,400. No projects are required at 14 treatment plants serving a combined population of 23,900.

Costs of needed municipal treatment works are roughly estimated to be $385,000. These estimates are for initial capital outlay for treatment plants only and do not cover sewers, interceptors, or preliminary investigations.

Table B9. Sources of pollution, industrial*

Industries	Sources of pollution (in number of plants)	Amount of pollution discharged to watercourse (in terms of equivalent number of people)
Producing organic wastes	--	--
Producing organic wastes	--	Undetermined
Producing inorganic wastes	--	Not applicable
Producing wastes of undetermined type	--	Undetermined
Total	0	--

*Industries having separate outlets and discharging wastes directly to watercourse or land.

Table D4.

Existing treatment facilities, municipal

Degree of treatment provided	Number		Population served
	Municipalities*	Plants	
Primary	-	-	6,400
Secondary	12	12	35,675
No treatment	1	--	900

*Includes incorporated or unincorporated municipalities, other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers; sanitary sewage wastes discharged by industry directly to watercourse and industrial wastes discharged into municipal sewage systems.

Table D5. Existing treatment facilities, industrial*

Type industry	Number of plants	Number of industrial plants having:		
		Treatment facilities	No treatment facilities	Undetermined facilities
	NA	INDUSTRIES		

*Industries having separate outlets and discharging wastes directly to watercourse or land.

Table D6. Adequacy of existing treatment facilities

Existing treatment facilities	Number	Adequacy with relation to:					
		Capacity			Operation		
		Satisfactory	Unsatisfactory	Undetermined	Satisfactory	Unsatisfactory	Undetermined
Municipal	22	14	8	0	17	5	0
Industrial	--	--	--	--	--	--	--

Table D7. Progress in pollution abatement

Year				
	Plants completed	Design population	Plants completed	Amount of waste treated (in terms of equivalent number of people)
1946	--	--	--	--
1947	--	--	--	--
1948	--	--	--	--
1949	--	--	--	--
1950	--	--	--	--

Table G.. requirements for municipal and industrial waste treatment plants*

Requirements	Municipal		Industrial
	Number	Population served by facilities	Number
New plant	[illegible]	[illegible]	--
Enlargement or additions to existing plant	[illegible]	[illegible]	--
Advanced treatment plant	[illegible]	[illegible]	--
No projects involved	[illegible]	[illegible]	--
Undetermined		--	--

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

Table H.. Status of treatment works projects to abate pollution, July 1, 195[illegible]

Status of project	Number	
	Municipal	Industrial
[illegible] action	--	--
Abatement ordered	--	--
Plans under preparation	[illegible]	--
Plans being approved	--	--
Contracts awaiting financing	--	--
Under construction	--	--
[illegible]	[illegible]	--

Table [illegible]. Project [illegible] - [illegible] for [illegible] municipalities [illegible]

[illegible]**	[illegible] period	[illegible] requirements	Needs
Californian:			
A	[illegible]	[illegible]	--
B	[illegible]	[illegible]	--
[illegible]	[illegible]	[illegible]	--
[illegible]	[illegible]	[illegible]	--
E	[illegible]	[illegible]	--
F	[illegible]	[illegible]	--
G	[illegible]	[illegible]	--
H	[illegible]	[illegible]	--
I	[illegible]	[illegible]	--

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

**The California municipalities listed as requiring no projects have been so classified because the recently established California State and Regional Water Pollution Control Boards have not had time to evaluate formally, determine and enforce treatment requirements.

SALTON SEA SUB-BASIN

Description and Economic Development

The Salton Sea Sub-Basin comprises an area of about 12,715 square miles, occuping the arid, desert area of southeastern California between the Colorado River watershed of California and the California extension of the Peninsular Ranges of Baja California. This flat, monotonous expanse of desert includes over one-half of Imperial County, about 15 percent of San Diego County, and a large part of the desert areas of Riverside and San Bernardino Counties. Practically the only permanent, natural water area in the Sub-Basin is the Salton Sea, formed in 1905-07 by the overflow of the Colorado River and covering 400 square miles in 1942 with the surface elevation at 241 feet below sea level.

The chief economic land unit of the Sub-Basin is the Imperial Valley that lies between the steep, rocky Chocolate Mountains on the east and the rugged Peninsular Range on the west. It extends from the international boundary to Riverside County and covers 1,450 square miles. In this area, the streams are intermittent except for the upper courses of a few which rise near the summit of the Peninsular Range and flow eastward. Streams on the mountains flow in deep canyons with well defined drainage areas. Over the alluvial fans and on the valley floor, channels are unstable and shifting. In the Imperial Valley, the principal water courses are: Arroyo Grande, San Felipe Creek, Carrigo Creek, Coyote Wash, Yuba Wash, and Pinto Wash on the western side and Salt Creek, Irish Wash, and Mammoth Wash on the Northeastern side. The wide, deeply intrenched channels of Alamo and New Rivers which originate in Mexico, extend north through the valley to Salton Sea. These channels were cut into the soft alluvial valley floor by overflow waters from the Colorado River that entered Salton Sea in 1905-07. At present, these channels carry mostly waste water and seepage from irrigation and storm waters.

The Imperial Valley area comprises 3,800 square miles of mountains and 1,450 square miles of valley. In the Peninsular Range on the west, the peaks average about 6,000 feet in elevation, whereas the average elevation of the Chocolate Mountains on the east side is about 2,500 feet. All of the central portion of the valley is lower than 37 feet below sea level and the prevailing slope is gradual from the Colorado River toward the Salton Sea. The remaining northern part of the Sub-Basin consists of typical western desert with dry, geologic lake beds and barren mountain ranges, up to four or five thousand feet in elevation. It is bordered on the west by the San Bernardino and San Jacinto Mountains.

The climate in the productive Imperial Valley is generally arid because the Peninsular Range intercepts most of the moisture from the ocean air that moves inland. The summers are long and hot and the winters are short and cool. The temperature extremes over a 33-year period at Brawley, south of the Salton Sea and in the central part of the valley, are 33 and 119°F., and the mean annual temperature is about 72°F. In the Peninsular Range winter temperatures are often below freezing. The average annual rainfall at Brawley for the 33-year period through 1941 was 2.59 inches. Annual precipitation along the summit of the Peninsular Range averages about 25 inches and, above 3,000 feet in elevation, much of the precipitation in winter occurs as snow.

Many of the steep slopes in the mountains are bare of soil and throughout the remainder of the mountains the soil cover is thin and poorly developed. In the valley the topsoils, which have been developed under desert conditions of high temperatures and little rainfall, are lacking in organic matter. But, the soils of the valley below the ancient beach line, derived from lacustrine and alluvial deposits, are generally dense, compact, well-stratified and fertile. In most of the cultivated areas, artificial drainage is necessary to prevent concentrations of alkali. There are nonproductive, strongly alkaline lands near the shore of Salton Sea and in low areas east and west of Brawley and Imperial.

The sparse, native vegetation at the lower elevations consists of desert plants, such as ocotillo, greasewood, paloverde and cacti. The Chocolate Mountains to the eastward are almost barren but some pinon, juniper, and stunted manzanita grow along their crests. On the western side of the Sub-Basin, the native vegetation varies from sagebrush at the lower levels to juniper, live oaks, ironwood, and manzanita in the Peninsular Range. Oak and pine forests occur above elevations of 3,000 feet.

The population(1950) of the Sub-Basin was estimated to be 117,200, an increase of about 27 percent from 1940. Approximately 37 percent of the population lives in the five largest cities; namely, El Centro (12,481), Brawley (11,885), Palm Springs (7,428), Calexico (6,402), and Indio (5,281). Most of the population lives in the rich, irrigated sections of the Imperial Valley. Only a few

people lived in the area before water was brought in from the Colorado River in 1905, but by 1940 the population had risen to about 57,000 in this fertile section of the Sub-Basin.

Agriculture is the basic industry of the arable part of the Sub-Basin. Its extent is determined by water supply. About 10,000 seasonal workers are employed in handling truck crops in packing and shipping sheds. During some years Imperial County practically leads the nation in the production of alfalfa and flax. In this county, fruit, truck and field crop acreage totalled 440,295 in 1949 and the value of the crops produced was about 88 million dollars. Much of the land is multicropped. San Bernardino County, the largest county in the United States, occupies a large but nonproductive part of the Sub-Basin. Most of its area within the Sub-Basin is within the Joshua National Monument. North and northwest of the Monument is a desert section, which is unproductive and unpopulated.

The Imperial Irrigation District, having a gross acreage of 612,660 acres, supplies nearly all the domestic and irrigation water in the productive valley area of the Sub-Basin. In 1943 the irrigation system included 170 miles of main canals and 1,550 miles of laterals. The irrigation duty for water for the 10-year period 1930-39 averaged 2.93 acre-feet per acre at an estimated cost of $1.67 per acre-foot.

Importation of water for both irrigation and domestic use is necessitated by high temperatures and low rainfall. Except for artesian wells of limited yield near Holtville, all the water used in the Imperial Valley in 1943 was supplied by the All-American Canal which taps the Colorado River.

Summary of Water Pollution Data

In this Sub-Basin there are 18 municipal sources of pollution which have a total connected population of 97,100. Fifteen of these sources with 91,900 persons connected discharge wastes with a total population equivalent of 91,200 to surface watercourses. Three other sources with 5200 persons connected discharge wastes with a total population equivalent of 3500 to land. Included as a source of pollution is one community in Mexico which discharges its wastes into a watercourse which flows into the United States. Five of the sources listed have primary treatment facilities and seven have secondary treatment facilities. The latter includes two communities which have satisfactory land disposal after preliminary sedimentation. Six of these municipal treatment plants are considered satisfactory and six unsatisfactory with regard to capacity and degree of treatment. The operation is considered satisfactory at eight of the municipal treatment plants, unsatisfactory at three and undetermined at one.

There have been four municipal treatment plants constructed in the Sub-Basin in the postwar years. These plants, all constructed in 1949, were designed for a total population of 9,300. Current municipal requirements as listed by the California State Department of Public Health include six new plants to serve over 66,000, enlargement of or additions to two treatment plants serving 2,100 people, and the replacement of three plants serving 17,100 people. Six plants serving approximately 10,000 people are satisfactory and no project is required at these places. The adequacy of facilities at one plant serving approximately 1,600 is undetermined. One of the communities listed as requiring a new plant is in Mexico. In addition, there are five communities which are not now sewered which should provide sewerage systems.

The estimated cost for needed municipal sewage treatment projects is $1,585,000.

The status of pollution abatement activities includes two communities where abatement has been ordered, three where plans are under preparation, three where construction is awaiting financing, one where facilities are under construction, and three for which the status is undetermined. One of the latter is the plant in Mexico where there is an international problem and legislation relative to this situation is pending in Congress.

There are only four known sources of industrial pollution in this Sub-Basin. Three of these are food processing plants and the other is a gypsum processing plant. All of these known sources have waste treatment facilities. Only one is considered satisfactory with regard to capacity and degree of treatment while three are considered unsatisfactory. The operation practices at three of the industrial waste treatment facilities are considered satisfactory and one unsatisfactory.

Enlargements or additions are required at two of the industrial waste treatment plants. The requirements are undetermined at the third industrial waste treatment plant and there is no requirement at the fourth plant. The project status of industrial waste treatment works to abate pollution is undetermined at two plants and no formal action has been taken at the third.

Table A_{10}. Sources of pollution, municipal

Municipalities*	Sources of pollution (in number of municipalities)	Population served by sewerage system	Amount of pollution discharged to watercourse (in terms of equivalent number of people)**
Having data on pollution load discharged to watercourse	18	97,110	91,140
Having population data available (Data on pollution load to watercourse incomplete or not available)	--	--	Not applicable
Total	18	97,110	--

*Includes incorporated or unincorporated municipalities, other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers; sanitary sewage wastes discharged by industry directly to watercourse.

Three of the 18 communities serving 5,140 of the 97,110 persons discharge wastes with a population equivalent of 3,530 to land.

**Includes industrial wastes discharged into municipal sewage systems.

Table B_{10} . Sources of pollution, industrial*

Industries	Sources of pollution (in number of plants)	Amount of pollution discharged to watercourse (in terms of equivalent number of people)
Producing organic wastes	3	13,800
Producing organic wastes	--	Undetermined
Producing inorganic wastes	1	Not applicable
Producing wastes of undetermined type	--	Undetermined
Total	4	--

*Industries having separate outlets and discharging wastes directly to watercourse or land.

Table C_{10}.

Existing treatment facilities, municipal

Degree of treatment provided	Number		Population served
	Municipalities*	Plants	
Primary	5	5	13,830
Secondary	7	7	16,910
No treatment	6	--	66,370

*Includes incorporated or unincorporated municipalities, other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers, or other population centers; sanitary sewage wastes discharged by industry directly to watercourse.

Table D_{10}. Existing treatment facilities, industrial*

Type industry	Number of plants	Number of industrial plants having:		
		Treatment facilities	No treatment facilities	Undetermined facilities
Manufacturing industries: Food and kindred products.....	3	3	--	--
Nonmanufacturing industries: Other mining industries.	1	1	--	--

*Industries having separate outlets and discharging wastes directly to watercourse or land.

Table F10. Adequacy of existing treatment facilities

Existing treatment facilities	Number	Adequacy with relation to:					
		Capacity			Operation		
		Satisfactory	Unsatisfactory	Undetermined	Satisfactory	Unsatisfactory	Undetermined
Municipal	12	6	6	--	8	3	1
Industrial	4	1	3	--	3	1	--

Table F11. Progress in pollution abatement

Year	Municipal		Industrial	
	Plants completed	Design population	Plants completed	Amount of waste treated (in terms of equivalent number of people
1946	--	--	--	--
1947	--	--	1	133,333
1948	--	--	--	--
1949	4	9,250	--	--
1950	--	--	--	--

Table F12. Requirements for municipal and industrial waste treatment plants*

Requirements	Municipal		Industrial
	Number	Population served by facilities	Number
New plant	6	4,300	--
Enlargement or additions to existing plant	2	2,100	2
Replace existing plant	3	11,100	--
No project required	1	9,000	1
Undetermined	1	1,000	1

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

Table F13. Status of treatment works project to abate pollution, July 1, 1950

Status of project	Number	
	Municipal	Industrial
No formal action	--	1
Abatement ordered	2	--
Plans under preparation	3	--
Final plans approved	--	--
Construction awaiting financing	3	--
Under construction	1	--
Status undetermined	3	2

Table I_{10}. Project list* - municipalities and industries requiring improvements for abatement of pollution, July 1, 1950

Name**	Population served	Project requirements	Remarks
California:			
A.....	5,100	Replace existing plant	--
B.....	11,000	New plant	--
C.....	6,500	Replace existing plant	--
D.....	800	New plant	--
E.....	13,000	New plant	--
F.....	1,200	New plant	--
G.....	5,500	Replace existing plant	--
H.....	100	Enlargement or addition	--
I.....	40,000	New plant	--
J.....	370	New plant	--
K.....	2,000	Enlargement or addition	--
L.....	1,500	Undetermined	--
M.....	--	Enlargement or addition	Ind. with a P.E. of 5,800 (E)
N.....	--	Enlargement or addition	Ind. with a P.E. of 8,000 (E)
O.....	--	Undetermined	Ind. with inorganic wastes

*The needs set forth in this table are based on presently available information. However, future studies and evaluations may result in some changes in these needs.

**The California municipalities listed as requiring projects have been coded because the recently established California State and Regional Water Pollution Control Boards have not had time to evaluate formerly determined waste treatment requirements.

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